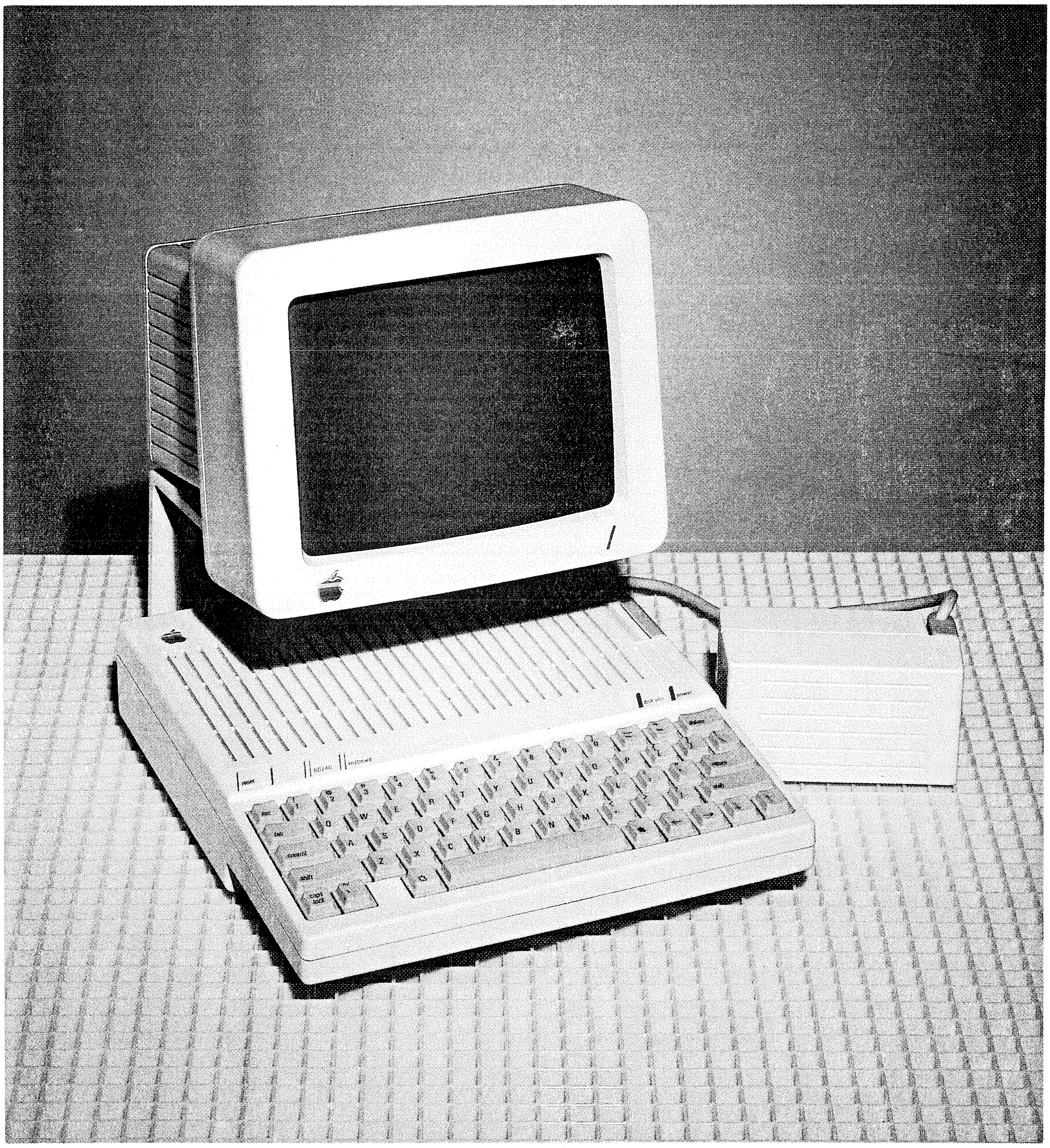
HOWARD W. SAMS & COMPANY CSCS7 08960

COMPUTERFACTS™

Technical Service Data

APPLE® IIc
MODELS A2S4000, A2M4090
COMPUTER/MONITOR



FEATURES COMPLETE SCHEMATICS • PRELIMINARY SERVICE CHECKS • TROUBLESHOOTING TIPS • EASY-READ WAVEFORMS • REPLACEMENT PARTS LISTS • SEMICONDUCTOR CROSS-REFERENCE

SAMS COMPUTERFACTS™

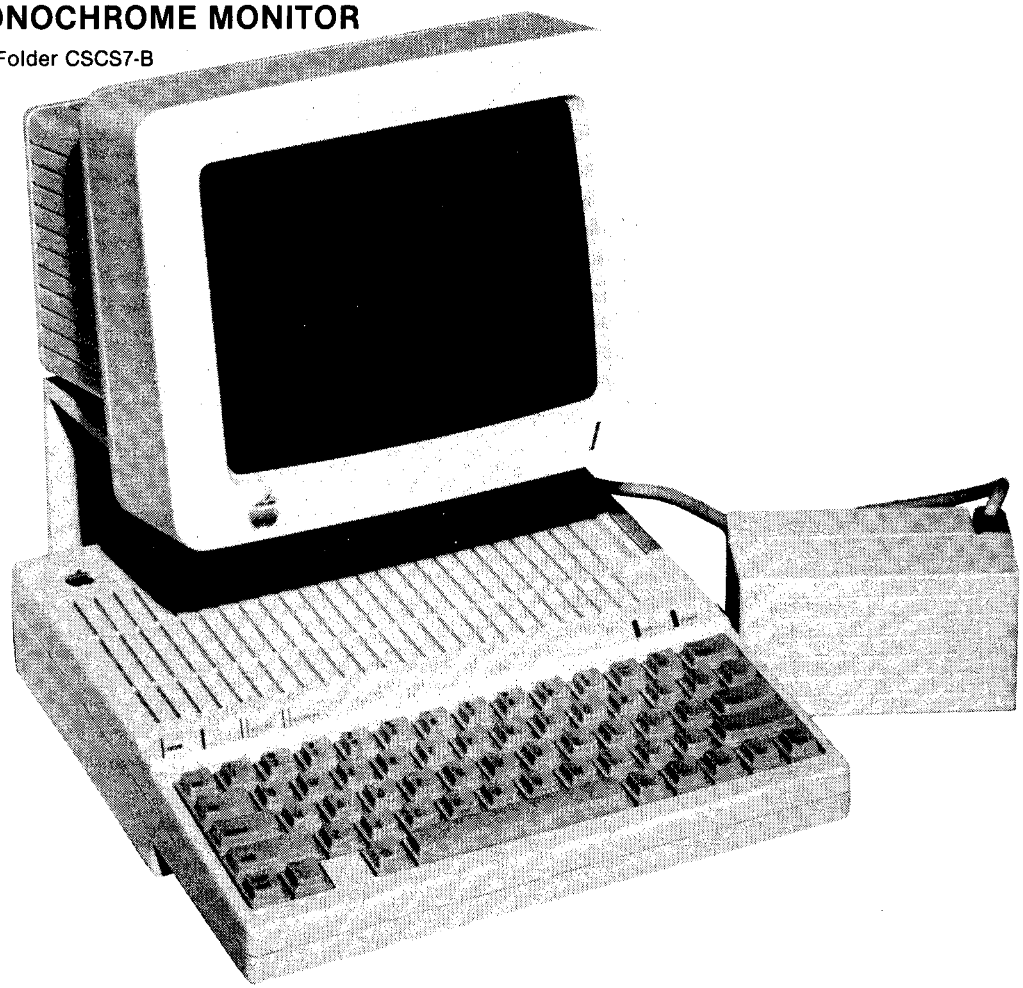
APPLE
MODEL IIc

KEYBOARD, SYSTEM BOARD
POWER SUPPLY

DISK DRIVE
See Folder CSCS7-A

MONOCHROME MONITOR
See Folder CSCS7-B

CSCS7 APPLE MODEL IIc



CSCS7 APPLE MODEL IIc

SAFETY PRECAUTIONS
See page 6.

PRELIMINARY SERVICE CHECKS
ENCLOSED

INDEX

Page
Block Diagram 12
Disassembly Instructions 4
General Operating Instructions 4
GridTrace Location Guide
  Switching Power Supply Board 20
  System Board 7
Line Definitions 20
Logic 17,18,19
Miscellaneous Adjustments 12
Parts List 13,14,15,16
Photos
  Keyboard 17
Photos (Continued)
  Switching Power Supply Board 21,23
  System Board 22,25
Safety Precautions 6
Schematics
  IC Pinouts & Terminal Guides 5,24
  Keyboard 2
  Notes 6
  Switching Power Supply 3,26
  System Board 2,27,28,29
Test Equipment 8
Troubleshooting 8,9,10,11,12

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SAMS COMPUTERFACTS™

APPLE
MODEL IIc
DISK DRIVE

CSCS7-A
APPLE
MODEL IIc

KEYBOARD, SYSTEM BOARD POWER SUPPLY

See Folder CSCS7

MONOCHROME MONITOR

See Folder CSCS7-B

CSCS7-A
APPLE
MODEL IIc

INDEX

Page
GridTrace Location Guide
  Analog Board 3
  Motor Speed Control Board 12
Line Definitions 5
Logic Chart 8
Miscellaneous Adjustments 9,10
Parts List 6,7,8
Photos
  Analog Board 2,3

Page
Photos (Continued)
  Mechanical-Top View 13
  Mechanical-Bottom View 13
  Motor Speed Control Board 11,12
Schematics
  Disk Drive 2
  IC Pinouts 2
  Terminal Guides and Notes 2
Troubleshooting 4,5

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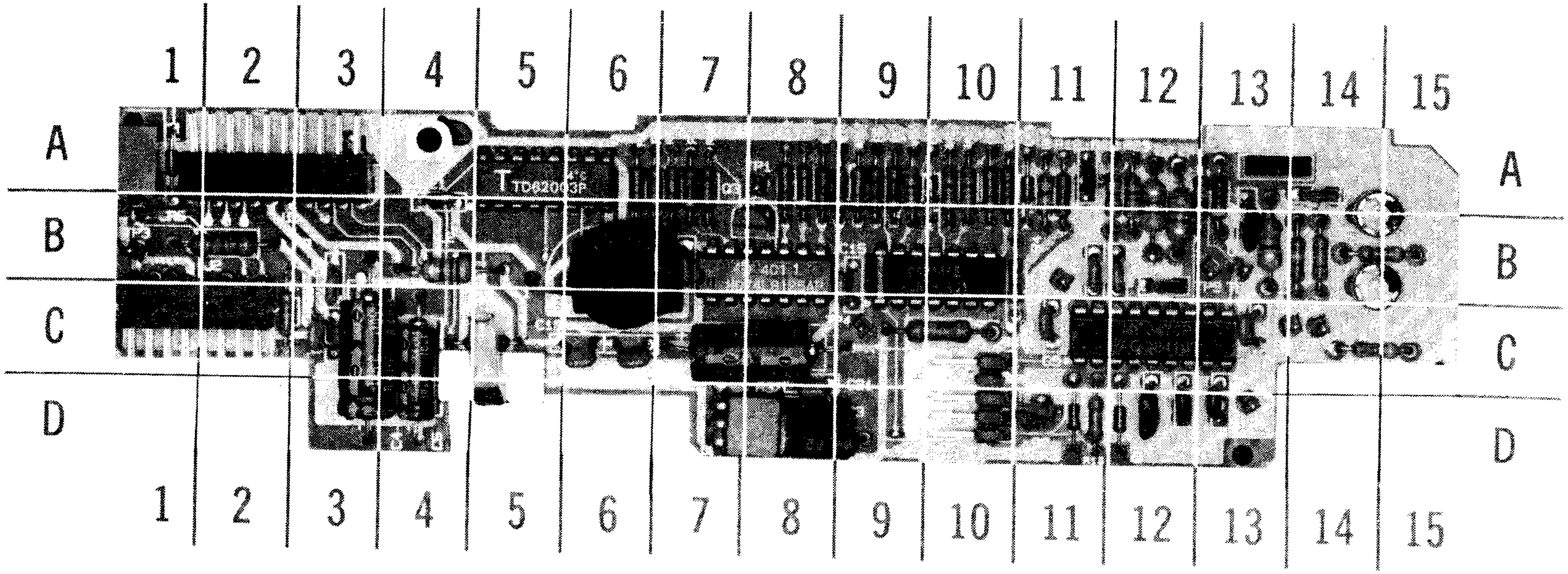


A Howard W. Sams GRIDTRACE™ Photo

DISK DRIVE ANALOG BOARD GridTrace LOCATION GUIDE

C1	A-4	C18	C-6	L4	A-12	R13	A-7	R30	A-9
C2	C-7	C19	C-6	L5	B-13	R14	A-9	R31	A-10
C3	B-3	C20	C-3	Q1	D-8	R15	A-8	R32	A-10
C4	C-3	C21	D-8	Q2	D-11	R16	A-8	R33	B-14
C5	C-4	C22	B-7	Q3	B-8	R17	A-9	R34	A-7
C6	D-12	CR1	D-12	R1	A-7	R18	A-11	R35	C-5
C7	D-12	CR2	D-11	R2	A-6	R19	A-11	R36	C-2
C8	D-13	CR3	A-11	R3	D-8	R20	C-14	R37	D-8
C9	C-11	CR4	A-10	R4	B-11	R21	B-14	TP3	B-1
C10	A-11	CR5	A-1	R5	A-9	R22	A-12	TP5	C-14
C11	B-12	J1	A-2	R6	A-9	R23	A-12	TP7	B-13
C12	C-13	J2	C-1	R7	A-10	R24	A-13	TP8	B-11
C13	B-13	J3	D-10	R8	B-2	R25	A-13	TP9	B-13
C14	A-14	J4	A-1	R9	A-6	R26	B-14	1B	C-12
C15	B-9	L1	C-6	R10	D-11	R27	B-14	3A	B-10
C16	B-11	L2	B-4	R11	C-10	R28	A-14	4B	B-8
C17	B-12	L3	A-12	R12	A-8	R29	A-10	4D	A-5

CSCS7-A

APPLE
MODEL IIc

DISK DRIVE ANALOG BOARD

CONTINUOUS OPERATION OF DISK DRIVE

To operate the Disk Drive continuously, type in and run the following program:

```
10 X = PEEK ( - 16151): X = PEEK ( - 16150)
```

Press the Control and Reset keys simultaneously to stop the Disk Drive.

POWER SUPPLY

Connect the Disk Drive to the Computer. Insert a blank diskette into the Disk Drive and turn On the Computer. Put the Computer in the Basic mode and type in and run the Basic program given in the "Continuous Operation of Disk Drive" section of this Troubleshooting guide.

Check for 11.5V at the emitter of Switch Transistor (Q1). If the voltage is missing at the emitter of Q1, check Choke Coil (L1) and Connector J1. If the voltage is missing at Connector J1, check the Disk Drive interface cable and connectors. If the voltage is present at the emitter of Transistor Q1, check for 11.5V at the collector of Q1. If the voltage is missing at the collector of Q1, check for a logic Low at pin 16 of Driver IC (4D). If pin 16 of IC 4D is Low, check Transistor Q1 and Resistor R3.

Check for 5.0V at the positive lead of Electrolytic C4 and – 11.3 V at the negative lead of Electrolytic C5. If either voltage is missing, check Connector J1 and the interface cable. Also check Choke Coil (L2).

WARNING
It is possible for a defective Disk Drive to write on or erase information from a write protected diskette. When checking a questionable Disk Drive, make sure that the diskette being used is backed up by at least one duplicate copy.

HEAD POSITION MOTOR

If the Head Position Motor (M2) is inoperative, check the voltages on pins 11 through 14 of Driver IC (4D). If any of the voltages are not approximately 11.5V, check the resistance of the associated Motor winding. Measure between pin 5 and pin 1, 2, 3 or 4 of Connector J2. Also check Connector J2 for good connections. If pin 11, 12, 13 or 14 of IC 4D is shorted to ground, check IC 4D.

If the voltages at pins 11 thru 14 of IC 4D are normal, type in and run the following basic program:

```
10 X = PEEK ( - 16151)
20 FOR Y = - 16153 TO - 16160 STEP-1
30 X = PEEK (Y)
40 NEXT Y
50 GOTO 20
```

WARNING: If the Head Position Motor is partially operative unplug Connector J2 before running the above program.

With the program running, check for pulses at pins 11 thru 14 of IC 4D. If the pulses are missing at any of the pins 11 thru 14, check for pulses at pins 3 through 6 of IC 4D. If pulses are present at pins 3 thru 6, check IC 4D. If the pulses are missing at any of the pins 3 thru 6, check the interface cable and Connector J1.

DISK DRIVE MOTOR MALFUNCTION

If the Disk Drive will not run, check for 11.5V at the emitter of Motor Control Transistor (Q3) on the Motor Speed Control board. If 11.5V is missing at the emitter of Q3, refer to the "Power Supply" section of this Troubleshooting guide. If 11.5V is present at the emitter of Q3, check for 11.2V at the emitter of Motor Control Transistor (Q4). If the voltage is missing at the emitter of Q4, check Resistor R9. If 11.2V is present at the emitter of Q4, check for approximately 6.9V at the collector of Q4. If the voltage is normal at the collector of Q4, check Drive Motor (M1) for an open winding.

If the voltage is missing at the collector of Q4, check for 0.7V at the base of Switch Transistor (Q2). If 0.7V is present at the base of Q2, check Transistors Q2, Q3 and Q4. If the voltage is missing at the base of Q2, check for a logic Low at pin 15 of Connector J1. If a logic Low is present at pin 15 of J1, check Transistor Q1, Diode CR5 and Resistor R7. If pin 15 of Connector J1 is not logic Low, check the interface cable and Connector J1.

If the Disk Drive spindle speed is not correct, perform the "Motor Speed Adjustment" procedure in the Adjustments section. If the spindle speed cannot be correctly adjusted, connect a scope to pin 1 of Speed Control IC (IC1) on the Motor Speed Control board and check for the 2V peak-to-peak tach signal shown in Figure 1. If the tach signal is missing at pin 1 of IC1, check for an open Drive Motor tach winding. Also check Diodes CR1 thru CR4 on the Motor Speed Control board. If the tach signal is present at pin 1 of IC1, check IC1 and associated components. Also check Switch Transistor (Q2) and Motor Control Transistor (Q4).

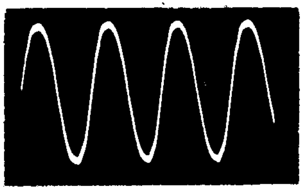


Figure 1

WILL NOT READ

Insert a blank diskette in the Disk Drive and close the door. Type in and run the following basic program:

```
10 X = PEEK ( - 16151)
20 X = PEEK ( - 16150)
30 X = PEEK ( - 16148)
40 X = PEEK ( - 16146)
50 X = PEEK ( - 16145)
60 X = PEEK ( - 16147)
70 GOTO 40
```

WARNING! Do not use a diskette containing important data when running this program. This program will write random data over any data already on the diskette.

Check for data pulses at pin 11 of IC 4B. If the data pulses are missing at pin 11 of IC 4B, check for pulses at pin 10 of IC 1B. If the pulses are present at pin 10 of IC 1B, check IC 4B. If the data pulses are missing at pin 10 of IC 1B, check the voltages and waveforms associated with IC 1B. If any voltages are abnormal or any waveforms are missing, check IC 1B and associated components. Also check the Read/Write head coils and Connector J3.

TROUBLESHOOTING (Continued)

WILL NOT WRITE

Verify that the write protect circuit is functioning properly by inserting a diskette that is not write protected. Check for a Low logic reading on pin 3 of IC 4B. If the logic reading is not Low, see the "Write Protect Does Not Function" section of this Troubleshooting guide.

Insert a blank diskette in the Disk Drive and close the door. Type in and run the program given in the "Will Not Read" section of this Troubleshooting guide.

WARNING! Do not use a diskette containing important data when running this program. The program will write random data over any data already on the diskette.

With the program running, check for pulses at pin 8 of IC 4B. if the pulses are missing at pin 8 of IC 4B, check for pulses at pin 9 of IC 4B. If pulses are present at pin 9 of 4B, check IC 4B. If the pulses are missing at pin 9 of IC 4B, check the interface cable and Connector J1. If the $\overline{\text{BWRITE REQ}}$ pulses are present at pin 9 of IC 4B, check for WRITE DATA pulses at pin 6 of IC 4B. If the pulses are missing at pin 6 of IC 4B, check for pulses at pin 5 of IC 4B. If the pulses are present at pin 5, check IC 4B.

If the WRITE DATA pulses are present at pin 6 of IC 4B, check for pulses at pins 1 and 5 of Write Amp IC (3A). If the pulses are missing at either pins 1 or 5, check IC 3A. If the pulses are present at both pins 1 and 5 of IC 3A, check Diodes CR1 and CR2. Also check the read/write head coils and Connector J3.

ERASE HEAD

Verify that the erase head is not open by checking for continuity between pins 2 and 3 of Plug P3. If the erase head checks good, type in and run the program given in the "Will Not Read" section of this Troubleshooting guide.

WARNING! Do not use a diskette containing important data when running this program. This program will write random data over any data already on the diskette.

Connect scope to pin 8 of IC 3A and set the time base to 5mSec. With the program running, check for approximately 1.0V peak-to-peak pulses. If the pulses are missing at pin 8 of IC 3A, check IC 3A. If the pulses are present at pin 8 of IC 3A, check for approximately 13.0V peak-to-peak pulses at the collector of Switch Transistor (Q2). If the pulses are missing at the collector of Q2, check Transistor Q2.

WRITE PROTECT DOES NOT FUNCTION

If a write protected disk is being written on, use the following procedure to check the write protect circuit. Insert a write protected diskette in the Disk Drive and close the door. Type in and run the program given in the "Will Not Read" section of this Troubleshooting guide. WARNING! Make sure that the diskette being used does not contain important data since this program will write random data over the data already on the diskette.

With the program running, check for a High logic reading on pin 3 of IC 4B. If pin 3 of IC 4B is logic High, the write protect circuit is working. If pin 3 of IC 4B is logic Low, check for a logic High on pin 2 of IC 4B. If pin 2 of IC 4B is logic High, check IC 4B. If pin 2 of IC 4B is logic Low, check for approximately 0V at the base of Transistor Q3. If the base of Q3 is approximately 0V, check Transistor Q3. If the base of Transistor Q3 is approximately 0.7V, check for a shorted Write Protect Detector Phototransistor.

If pin 3 of IC 4B is logic High when attempting to write on a non-write protected diskette, check for a logic Low on pin 2 of IC 4B. If pin 2 of IC 4B is logic Low, check IC 4B. If pin 2 of IC 4B is logic High, check Transistor Q3. If Transistor Q3 is good, check the Write Protect Detector and Resistor R36.

LINE DEFINITIONS

BWRITE REQ	Buffered Write Request
ENABLE	Enable
READ DATA	Read Data
WRITE REQ	Write Request

Any Bar above any Alphabetical or numerical combination indicates line active in a low (0) state.

PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA					
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
DISK DRIVE ANALOG BOARD								
CR1 thru CR5	1N4148		GE-514	NTE519	ECG519	SK3100/519	WEP925/519	103-131
Q1	2SB1080							
Q2	2N3906		GE-82	NTE159	ECG159	SK3466/159	WEP62/159	121-Z9003
Q3	2N3904		GE-123AP	NTE123AP	ECG123AP	SK3854/123AP	WEP736/123A	121-Z9000A
1B	MC3470P			NTE3470	ECG3470			
3A	CA3146E					SK3697		221-94
4B	HD74LS125AP		74LS125A	NTE74LS125A	ECG74LS125A	SK74LS125A		HE-443-811
4D	TD62003P			NTE2013	ECG2013	SK9093/2013		
DISK DRIVE MOTOR SPEED CONTROL BOARD								
CR1,CR2	1S1555		GE-300	NTE177	ECG177	SK9091/177	WEP1062/177	103-131
CR3 thru CR5	MA150		GE-514	NTE519	ECG519	SK3100/519	WEP925/519	103-131
Q1,Q2	2SC1815		GE-62	NTE85	ECG85	SK3124A/289A	WEP66/199	121-Z9065
Q3	2SA1015		GE-269	NTE290A	ECG290A	SK9132	WEP911/290A	121-Z9003*
Q4	2SB596-0		GE-250	NTE197	ECG197	SK3083/197	WEP757/197	121-988-03
IC1	CX065B							

* Lead configuration may vary from original.

WIRING DATA

Shielded Hook-up Wire	Use BELDEN No.	8401 or 8421 (Single-Conductor) 8208 (Two-Conductor) 9534 (Four-Conductor)
General-use Unshielded Hook-up Wire	Use BELDEN No.	8529 (Solid) Available in 13 Colors 8522 (Stranded) Available in 13 Colors
75-Ohm Input Lead	Use BELDEN No.	8241

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

CAPACITORS

Items Not Listed Are Normally Available At Local Distributors.

ITEM No.	RATING	MFGR. PART No.
	DISK DRIVE ANALOG BOARD	
C7	330 NPO 50V 5%	
C8	330 NPO 50V 5%	
C10	100 NPO 50V 5%	
C11	510 NPO 50V 5%	
C13	.0033 NPO 50V 5%	

CONTROLS (All wattages ½ watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
	DISK DRIVE ANALOG BOARD			
R28	Threshold	10K	8418(1)	
R33	Pulse Width Duration	10K	8418(1)	
	DISK DRIVE MOTOR SPEED CONTROL BOARD			
VR1	Speed	20K		

(1) Number on unit.

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
	DISK DRIVE ANALOG BOARD			
R19	634 1% 1/4W Metal Film			
R22	887 1% 1/4W Metal Film			
R23	887 1% 1/4W Metal Film			
R30	137 1% 1/4W Metal Film			
R31	137 1% 1/4W Metal Film			
R32	576 1% 1/4W Metal Film			
	DISK DRIVE MOTOR SPEED CONTROL BOARD			
R2	68K 1% 1/4W Metal Film			
R10	5100 3% 1/4W Metal Film		QW251	

COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.
	DISK DRIVE ANALOG BOARD	
L1	RF Choke	
L2	RF Choke	
L3	Peaking	
L4	Peaking	
L5	Peaking	

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
LED1	LED		Busy, Red
M1	Motor		Drive
M2	Motor		Head Position
M3	Head		Read/Write, Erase
M4	Sensor		Write Protect
	PC Board		Analog Board
	PC Board		Motor Speed Control Board

CABINET & CABINET PARTS (When ordering specify model, chassis & color)

MECHANICAL PARTS LIST

Reference number assigned for parts location.

REF. NO.	PART NO.	DESCRIPTION
1		Door Assembly
2		Door Spring
3		Drive Belt
4		Hub Support
5		Hub Frame
6		Arm Support Assembly
7		Tension Pulley
8		Head Assembly
9		Eject Spring
10		Eject Plate
11		Carriage Stopper
12		Tension Spring
13		Stepper Pulley

DISK DRIVE LOGIC

PIN NO.	IC 4B	IC 4D
1	L(1)	H
2	L(1)	L
3	L(1)	L(2)
4	P	L(2)
5	P	L(2)
6	P	L(2)
7	L	P
8	P	L
9	P	H
10	L(1)	P
11	P	H(2)
12	P	H(2)
13	L	H(2)
14	H	H(2)
15		H
16		L

Voltages, logic readings and waveforms taken on the Disk Drive while running the following program (with DOS 3.3) and during the period when the Head is not moving unless noted. An initialized diskette, with DOS 3.3 only (no other programs or data), was used in the Disk Drive. Note: Put the Caps Lock key in the down position.

```
10 DS = CHRS(4)
20 PRINT DS; "OPEN SAMS"
30 PRINT DS; "WRITE SAMS"
40 FOR X = 1 TO 50
50 PRINT "THIS IS A TEST"
60 NEXT X
70 PRINT DS; "CLOSE"
80 GOTO 20
```

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No light On)

(1) Probe indicates H if diskette is write protected or Head Position Motor is operating.
(2) Probe indicates P when Head Position Motor is operating.
(3) Readings taken after pressing Space Bar on keyboard.
(4) Probe indicates H when any key pressed except Control, Shift, Open Apple, Closed Apple and Reset keys.
(5) Probe indicates H when Caps Lock key is up.
(6) Probe indicates P when any key pressed except Control, Shift, Open Apple, Closed Apple and Reset keys.
(7) Probe indicates P when Computer is in "Basic" mode.
(8) Probe indicates L when the Control key is pressed.

MISCELLANEOUS ADJUSTMENTS

WARNING

It is possible for a defective Disk Drive to write on or erase information on a diskette even if the diskette has been write protected. Check a questionable Disk Drive by first using a diskette that contains programs that have been duplicated on another diskette. Do not leave the alignment diskette in the drive while checking voltages and waveforms unless so instructed in the alignment procedures. The test equipment may cause the disk drive circuits to erase sections of the alignment diskette even when the diskette is write protected with a write protect tab.

EQUIPMENT

Use a Disk Drive test program or Disk Drive Tester capable of turning the Disk Drive On, putting the Disk Drive in Read mode and moving the Head to any track. Use a Dysan Analog Alignment Diskette 208-10 when an alignment diskette is specified in the alignment procedures. Note: The Dysan Alignment Diskette has only alignment patterns on it and does not contain any alignment programs.

MOTOR SPEED ADJUSTMENT

Run the following program to keep the Disk Drive running continuously.

```
10 X = PEEK ( - 16151): X = PEEK ( - 16150)
```

Insert a diskette into the Disk Drive and close the door. Set the Disk Drive on its side so the strobe pattern on the spindle pulley is visible. Use a fluorescent light to view the strobe pattern. Use the outside pattern if a 60 cycle light is being used or the inside pattern if a 50 cycle light is being used. Adjust the Speed Control (VR1) until the strobe pattern appears to stand still.

RADIAL ALIGNMENT

Connect the channel 1 input of a scope to TP8 and the channel 2 input to TP9. Set the scope sweep time to 20mSec, vertical inputs to .2V range and AC input, mode switch to Add mode and one channel inverted. Insert the Alignment Diskette into the Disk Drive and close the door. Turn the Disk Drive On and set the Head to track 16. Observe the two lobes that appear on the scope (trigger the scope on the index burst that occurs at the beginning of the two lobes). The amplitude of the lobes should be within 70% of each other (See Figure 1). If the lobe amplitudes are not within 70% of each other, loosen the two phillips screws holding the Head Position Motor (M2) and rotate the motor until the two lobes are equal or within 70% of each other. Retighten the Head Position Motor screws and recheck the radial alignment by stepping the Head to track 39 and back to track 16, then step the Head to track 00 and back to track 16, checking the two lobes for proper amplitudes each time the Head is on track 16.

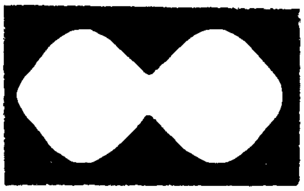
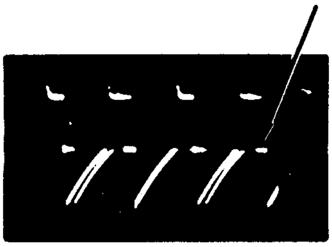


Figure 1

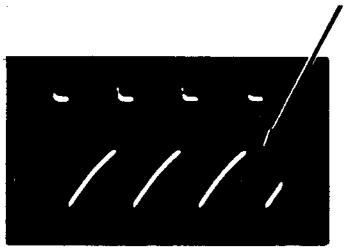
READ CIRCUIT ADJUSTMENT

Connect the channel 1 input of a scope to TP5 and channel 2 input to TP7. Set the scope to Add mode, sweep time to 2μSec vertical inputs to 2V range and trigger on channel 2. Turn the Disk Drive On and set the Drive to Read mode with the Head on Track 00 (to read the 125kHz pattern on the Alignment Diskette). Insert the Alignment Diskette in the Drive and close the door. Adjust the Threshold Control (R28) for MINIMUM jitter on the leading edges of the pulses and adjust the Pulse Width Duration Control (R33) for MINIMUM crossover distortion on the trailing edges of the pulses. (See Figures 2 and 3).



CROSSOVER
DISTORTION

FIGURE 2



MINIMUM
DISTORTION

FIGURE 3

Note: The following procedures can also be used for the Read Circuit adjustment.

Turn the Computer On and type in and run the following Basic program.

```
10 X = PEEK ( - 16151)
20 X = PEEK ( - 16150)
30 X = PEEK ( - 16148)
40 X = PEEK ( - 16146)
```

The program will turn the Disk Drive On in Read mode. Insert the Alignment diskette into the Disk Drive and close the door. Manually set the Head back to track 00. Hook up the scope and adjust Controls R28 and R33 using the instructions given in the first procedure.

MISCELLANEOUS ADJUSTMENTS (Continued)

AZIMUTH CHECK

Connect the channel 1 input of a scope to TP8 and the channel 2 input to TP9. Set the sweep time to .5mSec range, the vertical inputs to the .2V range and AC input and set the mode switch to add mode with one channel inverted. Insert the Alignment diskette into the Disk Drive and close the door. Turn the Disk Drive On and set the Head to track 34. A pattern of four vertical bars should appear on the scope (trigger the scope on the index burst that occurs at the beginning of the bars). The correct azimuth is indicated when the two inside bars are longer than the two outside bars. See Figure 4.

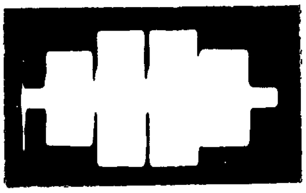


Figure 4

TRACK 00 STOP ADJUSTMENT

Connect the input of a scope to TP9. Set the scope vertical input to the .5V range, AC input and the sweep time to 10μSec. Insert the Alignment Diskette into the Disk Drive and close the door. Turn the Disk Drive On and set the Head to track 00. Verify that the Head is on track 00 by checking for a .5V peak to peak, 125kHz signal at TP9. Loosen the phillips screw holding the track 00 stop. Adjust the Stop for a clearance of .005″ between the Stop and the raised cam and retighten the track 00 Stop screw. See Figure 5.

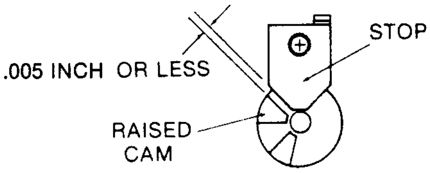
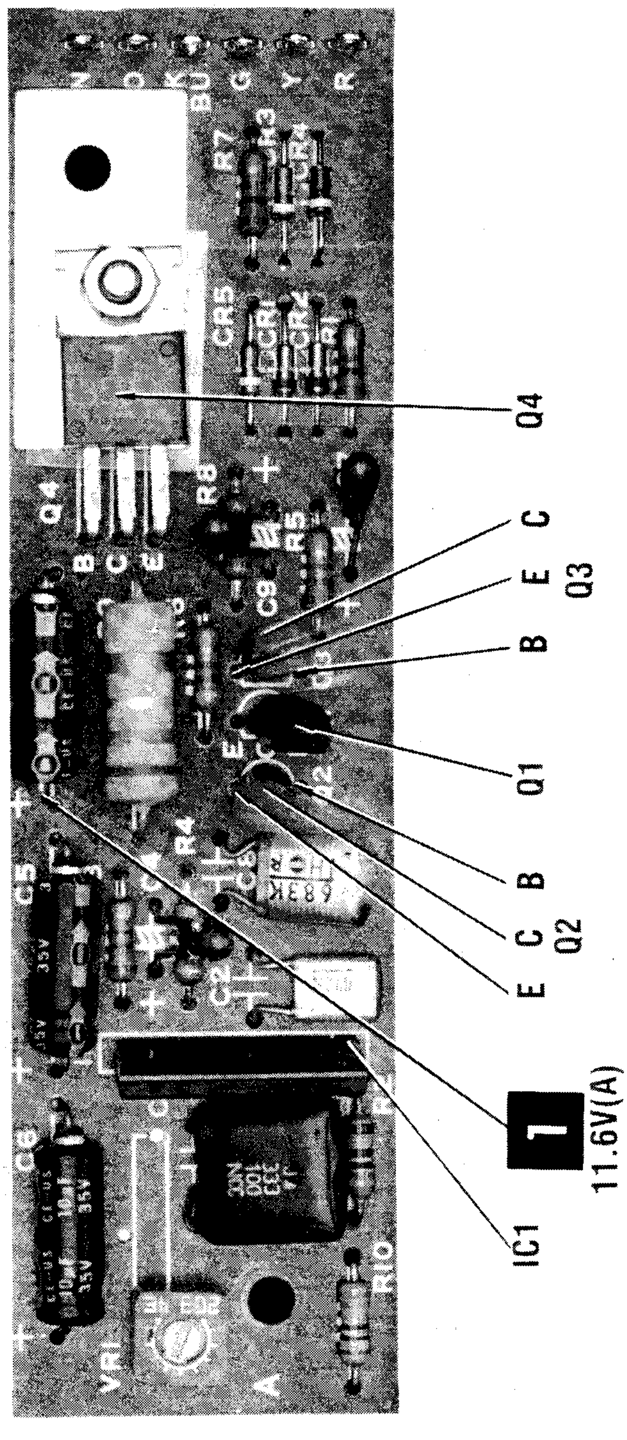
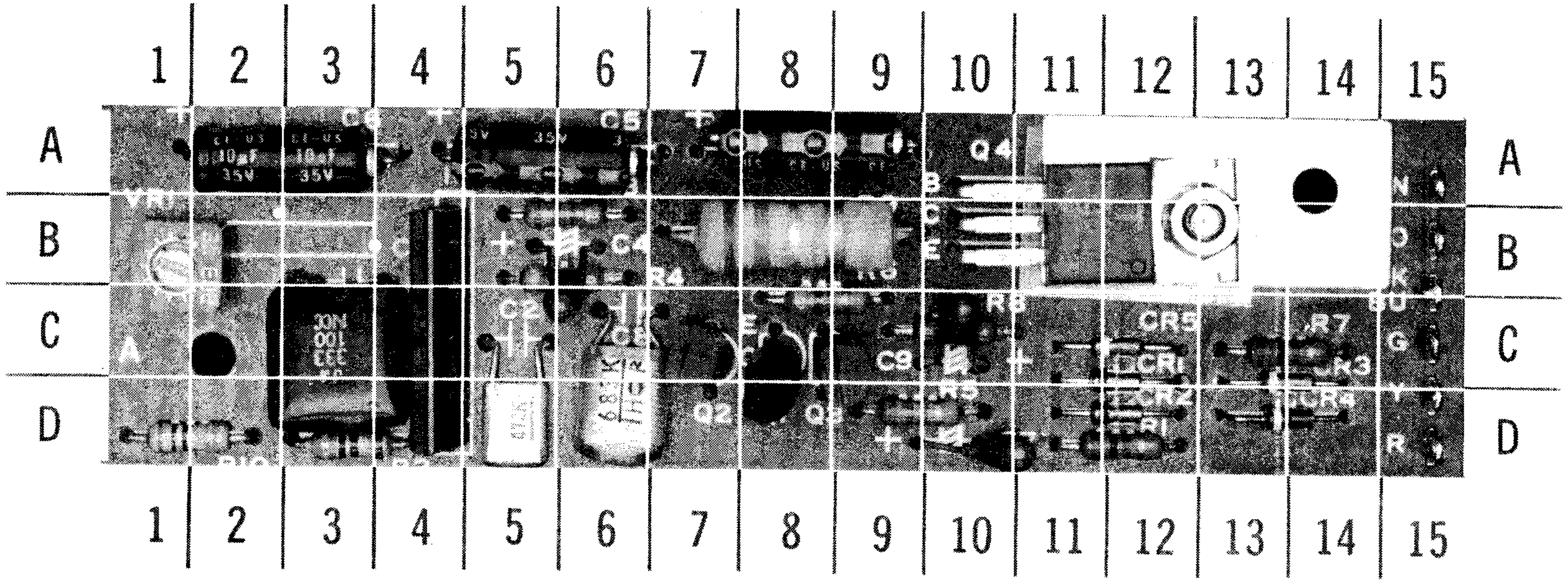


Figure 5


Q4
C
E
B
Q3
Q1
B
C
E
Q2
1
11.6V(A)
IC1

ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED.

DISK DRIVE MOTOR SPEED CONTROL BOARD A Howard W. Sams CIRCUITRACE® Photo


1
2
3
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5
6
7
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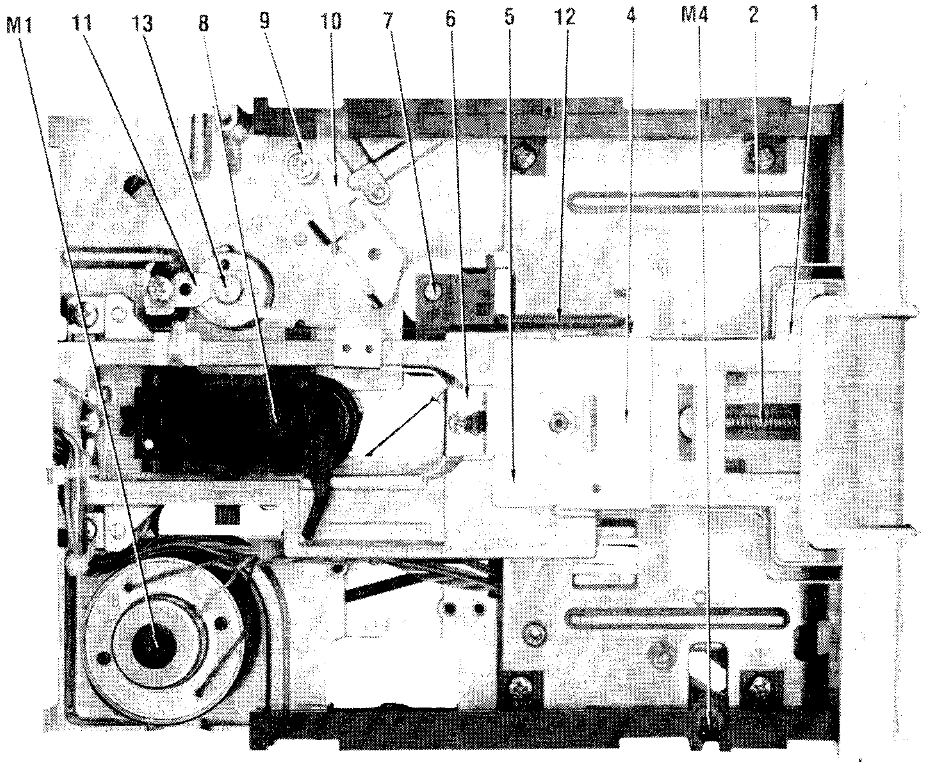
11
12
13
14
15
A
B
C
D
VR1
C6
C5
C4
C2
C8
R4
Q4
B
C
E
R8
C9
R5
Q2
Q3
CR5
CR1
CR2
R1
R7
R3
CR4
N
O
K
BU
G
Y
R

A Howard W. Sams GRIDTRACE™ Photo

DISK DRIVE MOTOR SPEED CONTROL BOARD

DISK DRIVE MOTOR SPEED CONTROL BOARD GridTrace LOCATION GUIDE

C1	A-8	C8	C-6	IC1	C-4	R3	B-6	R10	D-2
C2	D-5	C9	C-10	Q1	C-8	R4	B-6	VR1	B-1
C3	C-3	CR1	C-12	Q2	C-7	R5	D-10		
C4	B-6	CR2	D-12	Q3	C-9	R6	C-8		
C5	A-6	CR3	C-14	Q4	B-11	R7	C-14		
C6	A-3	CR4	D-14	R1	D-12	R8	C-8		
C7	D-10	CR5	C-12	R2	D-3	R9	B-8		


M1
11
13
8
9
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7
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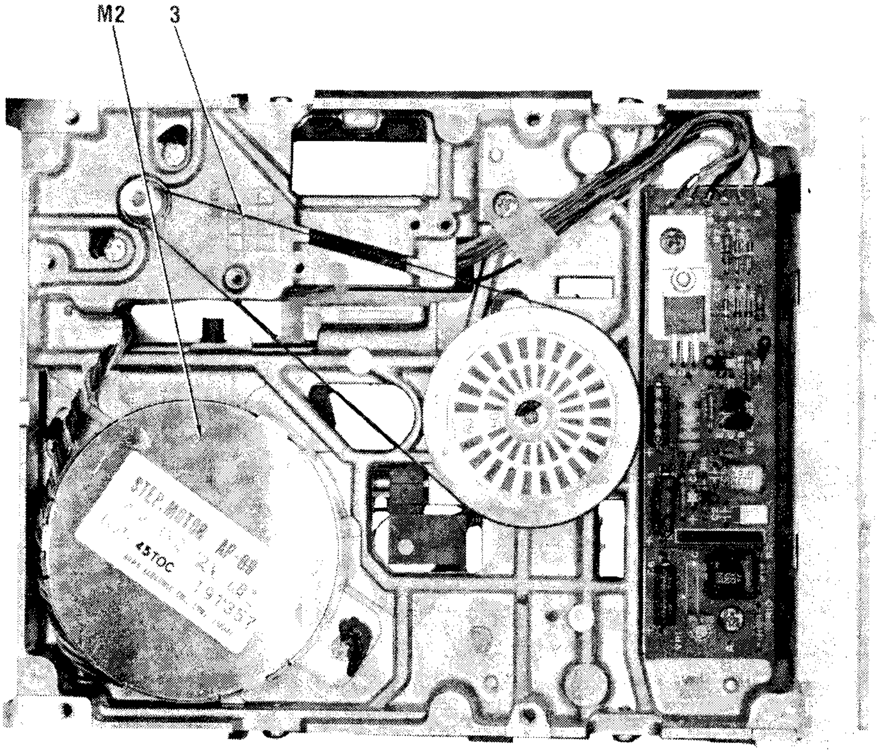
5
12
4
M4
2
1

MECHANICAL-TOP VIEW


M2
3
STEP MOTOR
45TOC

MECHANICAL-BOTTOM VIEW

SAMS COMPUTERFACTS™

APPLE
MODEL IIc

MONOCHROME MONITOR

CSCS7-B
APPLE
MODEL IIc

CSCS7-B
APPLE
MODEL IIc

KEYBOARD, SYSTEM BOARD POWER SUPPLY

See Folder CSCS7

DISK DRIVE

See Folder CSCS7-A

INDEX

Page

Disassembly Instructions 13
GridTrace Location Guide
  Monitor Board 4
Miscellaneous Adjustments 3
Parts List
  Monitor 6,7,8
Photos
  Cabinet View 13
  CRT Socket Board 11
  Monitor Board 9,10

Page

Photos (Continued)
  Monitor Power Supply Board 12
Resistance Measurements 2
Schematics
  Terminal Guides and Notes 2
  Monitor 2
Servicing in the Field 13
Troubleshooting 5
Troubleshooting Aid 4

SAMS™ **Howard W. Sams & Co., Inc.**
4300 West 62nd Street, P.O. Box 7092, Indianapolis, Indiana 46206 U.S.A.

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed.

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Printed in U.S. of America. **85CS14956** **DATE 9-85**

MISCELLANEOUS ADJUSTMENTS

ALIGNMENT TOOLS	GC ELECTRONICS
L503	5000, 5009, 8276
L505	9440, 8282, 8606

NOTE: Pattern generator with 1Vp-p into 75 ohms (VTR Standard) output used with appropriate pattern.

INITIAL MONITOR TEST

Connect a crosshatch generator to the Video In Jack. Turn the Monitor On and adjust the Brightness and Contrast controls for the best display. Check the adjustment of the Vert Hold, Horiz Hold, Vert Lin, Vert Size and Focus controls. If any of these controls produce erratic operation, clean that control with contact cleaner and recheck.

ADJUSTMENTS

NOTE: Connect a crosshatch generator to the Video In Jack for the following adjustments.

FOCUS ADJUSTMENT

Adjust the Focus Control (VR502) for sharp, well defined lines on the display.

VERT AND HORIZ HOLD ADJUSTMENT

Adjust the Vert Hold Control (VR401) and Horiz Hold Control (VR501) for the most stable display.

VERT SIZE ADJUSTMENT

Adjust the Vert Size Control (VR403) for the desired height on the display.

VERT LIN ADJUSTMENT

Adjust the Vert Lin Control (VR402) for even spacing between the vertical lines on the display.

VOLTAGE REGULATOR ADJUSTMENT

Connect a voltmeter to the collector of Voltage Regulator Transistor (Q701). Adjust the Voltage Regulator Control (VR701) for 12.0V.

SUB BRIGHTNESS ADJUSTMENT

Connect a crosshatch generator to the Video In Jack. Set the Brightness and Contrast Controls to Maximum clockwise position.

Adjust the Sub Brightness Control (VR503) for Maximum brightness without retrace lines.

CENTERING ADJUSTMENT

Center the CRT display by adjusting the two magnetic centering rings located on the deflection yoke rear cover.

HORIZ LIN ADJUSTMENT

Adjust the Horiz Lin Coil (L503) for even spacing between the horizontal lines on the display.

WIDTH ADJUSTMENT

Adjust the Width Coil (L505) for the desired width on the display.

SUB CONTRAST

Set the Brightness and Contrast Controls to Maximum clockwise position. Adjust the Sub Contrast Control for best display with no distortion.

TROUBLESHOOTING AID

Note: Waveforms taken with triggered scope, Keyed-Rainbow generator. Schematic voltages measured with digital meter, no signal. Controls adjusted for normal operation.

PICTURE OR SOUND

NO PIC, NO RASTER: Check AC power supply, sources generated from Horizontal Output Transformer (T502) and Video circuit. Refer to "Troubleshooting" Power Supply, Video and Horizontal circuits.

NO PIC, HAS RASTER: Refer to "Troubleshooting" Video circuit.

LOW OR EXCESSIVE BRIGHTNESS: Check Video and Luminance circuits. Refer to "Troubleshooting" Video circuit.

SWEEP

NO RASTER: Check HV Rectifier, Rectifiers D20 and D21 and Horizontal circuit. Refer to "Troubleshooting" Horizontal circuit.

NO VERT DEFLECTION: Refer to "Troubleshooting" Vertical circuit.

POOR VERT LIN OR FOLDOVER: Refer to "Troubleshooting" Vertical circuit.

POOR HORIZ LIN OR FOLDOVER: Refer to "Troubleshooting" Horizontal circuit.

NARROW PICTURE: Refer to "Troubleshooting" Horizontal circuit.

VERT OFF FREQUENCY: Refer to "Troubleshooting" Vertical circuit.

HORIZ OFF FREQUENCY: Refer to "Troubleshooting" Horizontal circuit.

SYNC

NO VERT/HORIZ SYNC: Refer to "Troubleshooting" Sync circuit.

MONITOR BOARD GridTrace LOCATION GUIDE

C101	F-3
C102	E-4
C103	C-4
C104	B-5
C105	C-6
C106	D-6
C107	A-7
C108	A-9
C109	B-7
C110	B-9
C111	C-4
C401	I-8
C402	I-8
C403	J-7
C404	I-6
C405	I-5
C406	J-6
C407	I-7
C408	H-6
C409	G-8
C410	H-8
C411	H-5
C412	G-5
C413	G-6
C501	D-6
C502	D-7
C503	D-7
C504	E-5
C505	E-5
C506	F-5
C507	E-5
C508	F-7
C509	E-6
C510	D-10
C511	E-12
C513	I-10
C514	B-10
C515	A-11
C516	I-13
C517	F-8
C518	J-9
C701	A-3
C702	D-1
C703	A-2
C704	G-3
D10	C-7
D11	C-8
D12	G-6
D13	F-8
D14	F-13
D15	F-13
D16	J-11
D17	G-9
D18	G-9
D19	F-8
D20	I-13
D21	H-9
D22	C-13
D701	E-2
D702	F-2
D703	F-2
D704	F-1
F701	H-3
IC11	H-6
IC12	E-5
IC701	B-2
J1	K-11
L101	C-3
L102	A-5
L103	B-8
L501	A-4
L502	E-9
L503	B-13
L505	C-11
P2	G-2
P3	D-2
P4	A-11
P5	A-10
P6	H-8
P7	A-11
Q11	A-9
Q12	B-8
Q13	A-5
Q14	C-6
Q15	C-5
Q16	E-3
Q17	D-4
Q18	D-12
R01	A-10
R101	J-12
R102	D-4
R103	E-4
R104	C-4
R105	C-5
R106	C-5
R107	B-4
R108	B-4
R109	C-5
R110	A-6
R111	B-6
R112	A-6
R113	A-9
R114	B-9
R115	B-7
R116	B-6
R117	C-7
R118	B-8
R119	D-4
R120	C-4
R121	D-5
R123	B-10
R124	B-7
R401	I-8
R402	J-8
R403	I-5
R404	H-7
R405	H-5
R406	I-5
R407	J-7
R408	H-7
R409	I-8
R410	G-7
R411	G-7
R412	F-7
R413	H-8
R501	D-7
R502	F-4
R503	F-5
R504	F-5
R505	E-7
R506	D-9
R507	I-12
R508	I-20
R510	C-12
R511	D-11
R512	C-13
R513	F-8
R514	I-12
R515	G-13
R516	G-9
R517	H-9
R518	J-10
R519	D-9
R701	B-1
R702	C-1
R703	E-1
R704	C-2
T2A	G-1
VR101	F-4
VR401	K-6
VR402	I-4
VR403	K-8
VR501	G-4
VR502	A-12
VR503	H-9
VR504	K-10
VR701	D-1

TROUBLESHOOTING

POWER SUPPLY

Check the AC Line Fuse (F771) and the DC Fuse (F701). If Fuse F771 is open, check Diodes D701 thru D704, Capacitor C771 and Electrolytic C701 for possible shorts. Also check Power Transformer (T2) for shorted windings. If Fuse F701 is open, check Electrolytics C704 and C412 for shorts. Also check Electrolytic C514 in the Horizontal Sweep Circuit for a possible short. If both fuses are good, check for 18.8V DC at the emitter of Voltage Regulator Transistor (Q701). If 18.8V is missing at the emitter of Q701, check for an open Diode D701 thru D704, an open Power Transformer T2 winding or an open Line Choke L771. Also check Power Switch SW1 and the power cord.

If the 18.8V is present at the emitter of Q701, check for 12V at the collector of Q701. If the voltage is missing or incorrect at the collector of Regulator Transistor Q701, check Transistor Q701, Resistor R705, Error Amplifier (IC701) and associated components. If 12V is present at the Collector of Q701, check Resistor R405 and Choke L101.

HORIZONTAL

If there is no high voltage, inject a horizontal drive signal at the base of Horizontal Output Transistor (Q18). If the high voltage returns, check Horizontal Driver Transformer (T501), Horizontal Processor (IC12), Resistors R505 and R506. Also check other components associated with the Horizontal Driver circuit and the Horizontal Processor IC. If the high voltage does not return when a horizontal drive signal is injected at the base of Horizontal Output Transistor (Q18), check Q18, Horizontal Output Transformer (T502), Deflection Yoke (DY1) and Diodes D14, D15, D17 and D18. Also check Horizontal Linearity Coil (L503), Width Coil (L505), Capacitors C511 and C516, Electrolytics C513, C514, C515, and C517. Check for possible shorts at the outputs of Diodes D20 and D21 that could load down the Horizontal Output Transformer.

Poor horizontal linearity or foldover problems may be caused by Capacitor C511, Electrolytics C514 or C515, Deflection Yoke DY1, Horizontal Linearity Coil L503 or Width Coil L505. Also check Resistor R510, R511 and R512 and Diode D22. If the horizontal sweep is off frequency, check the adjustment of the Horizontal Hold Control (VR501). If horizontal sync cannot be obtained with the Horizontal Hold Control, check the Horizontal Processor (IC12) and its associated components. If the monitor has a narrow raster, check the 11.8V source in the power supply. If the 11.8V source is normal, check the waveform at the base of the Horizontal Output Transistor (Q18). If the drive waveform at the base of Q18 has insufficient amplitude, check the voltages on the Horizontal Processor IC12. Also check Capacitors C501, C502, C503 and C509 in the Horizontal Drive circuit. If the waveform at the base of the Horizontal Output Transistor is normal, check Resistors R510 and R511, Coils L503 and L505 and Electrolytic C515 in the horizontal yoke circuit.

VIDEO

Inject a video signal at the Video Input Jack (J1) and check the waveform at the emitter of the Video Preamplifier Transistor (Q16). If the waveform is missing at the emitter of Q16, check Resistor R103, Capacitor C101, Electrolytic C102 and Transistor Q16. If the waveform is present at the emitter of Q16, check the waveform at the base of Video Amplifier Transistor (Q13). If the waveform is missing at the base of Q13, check Video Amplifier Transistor (Q15), Resistors R104, R106, R108 and R109 and Electrolytic C104. If the waveform is present at the base of Transistor Q13, check the waveform at the base of Video Driver Transistor (Q11). If the video signal is missing at the base of Q11, check Transistor Q13, Resistors R110, R112 and R113, Electrolytics C107 and C108, Contrast Control (VR1) and Horizontal Blanking Transistor (Q12).

If the video waveform is present at the base of Q11, check the waveform at the base of Video Output Transistor (Q19) on the CRT Board. If the waveform is missing on the base of Q19, check Transistor Q11 and Resistor R114. If the waveform is present at the base of Q19, check the waveform at pin 2 of the CRT. If the video signal is missing at pin 2 of the CRT, check Transistor Q19, Resistors R151, R153 and R157, Coil L151, and Electrolytic C151. If the video signal is present at pin 2 of the CRT, check the voltages on pins 5, 6 and 7 of the CRT. If all voltages on the CRT are normal, check the CRT. If the monitor has low brightness or excessive brightness, check the voltages on Transistors Q11 and Q19.

SYNC

If there is no horizontal or vertical sync, check the composite video waveform at pin 1 of Horizontal Processor (IC12). If the waveform is missing at pin 1 of IC12, check for the composite video signal at the base of Sync Amplifier Transistor (Q17). If the composite video signal is present at the base of Q17, check Transistor Q17, Resistors R120 and R121 and Electrolytic C111. If the composite video signal is missing at the base of Q17, check Resistor R119 and Transistor Q16. If the composite signal is present at pin 1 of the Horizontal Processor IC12, check IC12 by substitution.

If there is no horizontal sync, check Horizontal Processor IC12 and its associated components. If there is no vertical sync, check for vertical sync pulses at pin 2 of IC12. If the vertical sync pulses are missing at pin 2 of IC12, check IC12. If there are vertical pulses present at pin 2 of IC12, check for vertical sync pulses at pin 1 of the Vertical Processor (IC11). If the vertical sync pulses at pin 1 of IC11 are missing or have low amplitude, check Resistors R401 and R402, Capacitors C401, C402 and C403. If the vertical sync pulses are normal at pin 1 of Vertical Processor IC11, check IC11 by substitution.

VERTICAL

If there is no vertical sweep, check the waveform at pin 8 of Vertical Processor (IC11). If the vertical sweep signal is present at pin 8 of IC11, check Electrolytic C409 and Deflection Yoke (DY1). If the vertical sweep signal is missing at pin 8 of IC11, check Vertical Processor IC11 and associated components. Poor vertical linearity or foldover may be caused by a defective component in the vertical feedback circuit. Check Resistors R404, R406, R407, R408 and R409, Controls VR402 and VR403 and Electrolytics C404, C406, C407, C408, C411 and Capacitor C410. If the Vertical sweep is off frequency, check Vertical Hold Control (VR401), Resistor R403 and Electrolytic C404. If these components check good, check IC11 by substitution. If vertical retrace lines appear in the raster, check Resistors R411 and R412, Diodes D13 and D19 and Capacitor C152 on the CRT Board.

CSCS7-B

APPLE
MODEL IIc

PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA					
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
D10 D11	3.9B2		GEZD-3.9	NTE5007A	ECG5007A	SK3A9/5007A	WEP1407/5007	
D12 D13	G18410							
D14 thru D16	G18415							
D17,D18 D19	G18419							
D20	G18337							
D21	G18419							
D22	G18410							
D701 thru D704	G2DG1							
IC11	AN5763							
IC12	AN5753							
IC701	L123CB		GEIC-260	NTE923D	ECG923D	SK3165/923D	WEP2331/923D	221-Z9020
Q11	2SC829B		GE-20*	NTE85	ECG85	SK3122	WEP829	121-Z9021
Q12	2SC828R		GE-61	NTE85	ECG85	SK3931/90	WEP828	121-972
Q13	2SC829B		GE-20*	NTE85	ECG85	SK3122	WEP829	121-Z9021
Q14	2SC828R		GE-61	NTE85	ECG85	SK3931/90	WEP828	121-972
Q15,Q16	2SC829B		GE-20*	NTE85	ECG85	SK3122	WEP829	121-Z9021
Q17	2SC828R		GE-61	NTE85	ECG85	SK3931/90	WEP828	121-972
Q18	BU406			NTE379	ECG379	SK9085/379	WEP379/379	121-Z9111
Q19	2SC1360A		GE-62	NTE199	ECG199	SK3132	WEP66/199	121-972
Q701	BD534L		GE-69A	NTE153	ECG153	SK3274/153	WEP746/153	121-988-03

* Lead configuration may vary from original.

WIRING DATA

High Voltage Lead	Use BELDEN No. 8869 (17 KV) or 8868 (24 KV)
Shielded Hook-up Wire	Use BELDEN No. 8401 or 8421 (Single-Conductor) 8208 (Two-Conductor)
General-use Unshielded Hook-up Wire	Use BELDEN No. 8529 (Solid) Available in 13 Colors 8522 (Stranded) Available in 13 Colors
75-Ohm Tuner Input Lead	Use BELDEN No. 8241

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

ELECTROLYTIC CAPACITORS Items Not Listed Are Normally Available At Local Distributors.

ITEM No.	RATING	MFGR. PART No.
C102	47 16V NP	
C107	47 16V NP	

ITEM No.	RATING	MFGR. PART No.
C108	10 16V NP	
C515	4 25V NP	

CAPACITORS Items Not Listed Are Normally Available At Local Distributors.

ITEM No.	RATING	MFGR. PART No.
C101	22 N220 50V	

ITEM No.	RATING	MFGR. PART No.
C502	33 NPO 500V 5%	

CONTROLS (All wattages ½ watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
VR1	Contrast	500		
VR101	Sub Contrast	500		
VR401	Vert Hold	100K		
VR402	Vert Linearity	10K		
VR403	Vert Height (Size)	50K		
VR501	Horiz Hold	500		
VR502	Focus	2M		
VR503	Sub Brightness	200K		
VR504	Brightness	200K		
VR701	Voltage Regulator	1000		

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
R404	6.8 2% 1.4W Metal Film		QW6D8	
R405	6.8 2% 1/4W Metal Film		QW6D8	
R408	1.1 2% 1/4W Metal Film		QW1D1	
R504	2700 2% 1/4W Metal Film		QW227	22-2246
R507	6.8 2% 1/4W Metal Film		QW6D8	
R516	6.8 2% 1/4W Metal Film		QW6D8	
R705	27 5% 10W WW		10W027	

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.
L101	RF Choke	
L102	RF Choke	
L103	RF Choke	

ITEM No.	FUNCTION	MFGR. PART No.
L151	RF Choke	
L771	Line Filter	

COILS & TRANSFORMERS

ITEM No.	FUNCTION	MFGR. PART No.	OTHER IDENTIFICATION	NOTES
DY1	Yoke Horiz 156uH 90° Vert 9.9mH	TMD-2728(1)		
L502	Width	HW-440(1)		
L503	Horiz Linearity	2449-717-0109(1)		
T2	Power	2869-239-0104(1)		
T501	Driver	027-0108-DD156(1)		
T502	Horiz Output	TMF-2222(1)		

For SAFETY use only equivalent replacement part.
(1) Number on unit.

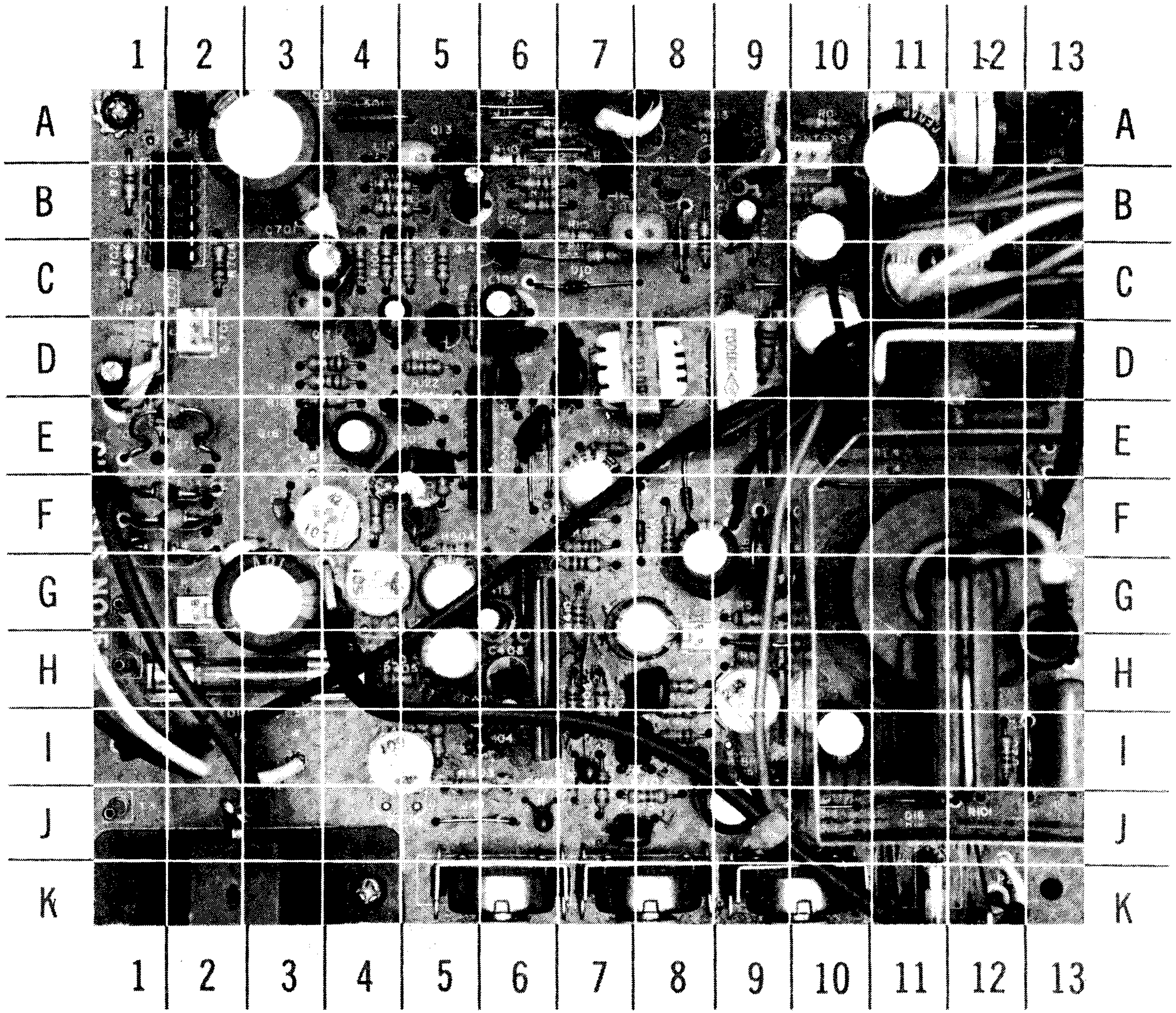
FUSE DEVICES

ITEM NO.	DESCRIPTION	MFGR. PART NO.		NOTES
		DEVICE	HOLDER	
F701	1.5A @ 250V Fast-Acting			
F771	750mA @ 250V Fast-Acting			

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
D01	LED		Power, Green
L501	Ferrite Bead		
L502	Ferrite Bead		
M1 Thru M5	Spark Gap		
P1	Cord		AC Power
SG1	Lamp		Neon
SW1	Switch		Power
V1	CRT		C10M42P31(D)-ARF-SB
	PC Board		Main
	PC Board		Power Supply
	PC Board		CRT Socket

CABINET & CABINET PARTS (When ordering specify model, chassis & color)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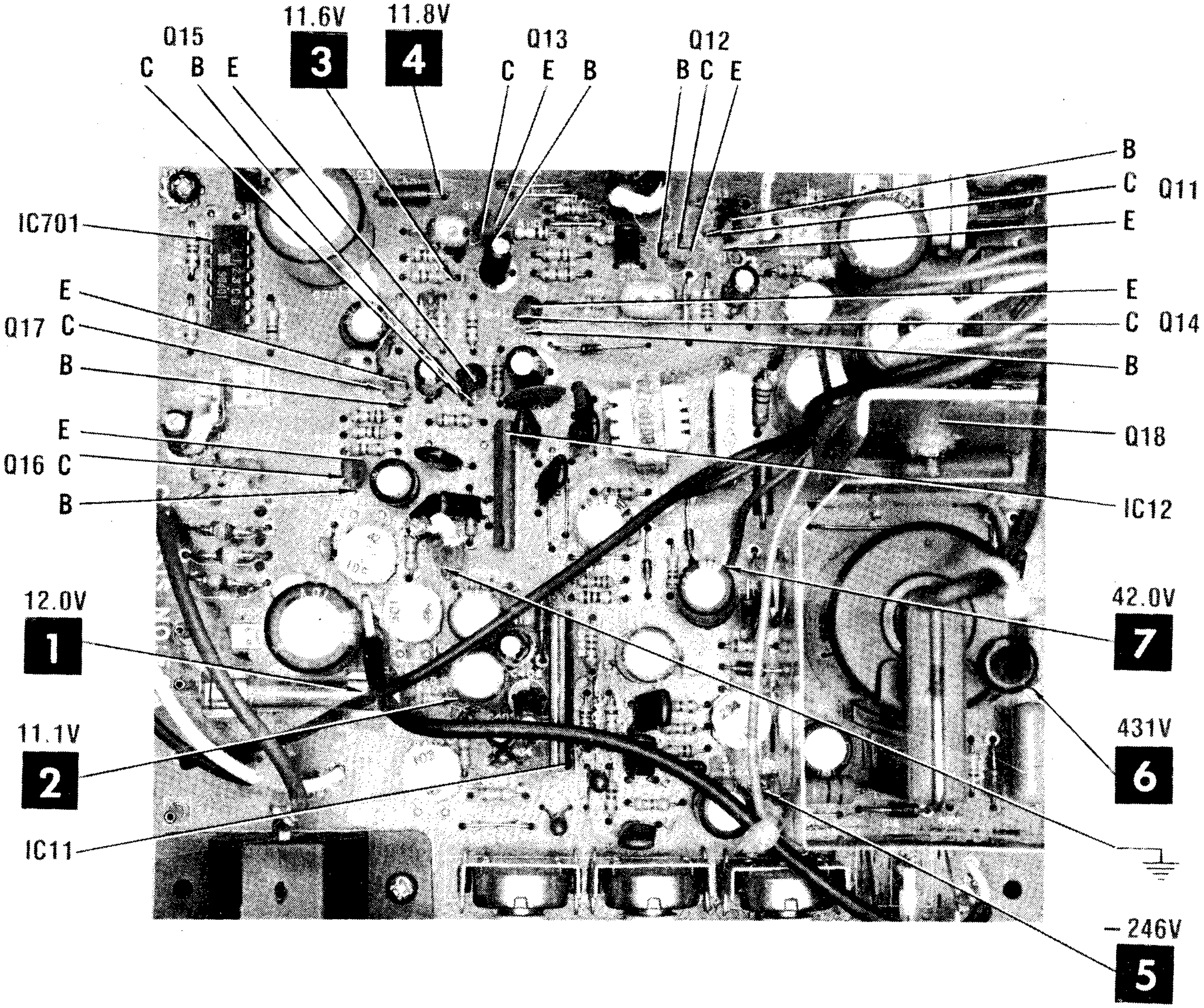
APPLE
MODEL IIc

MONITOR BOARD

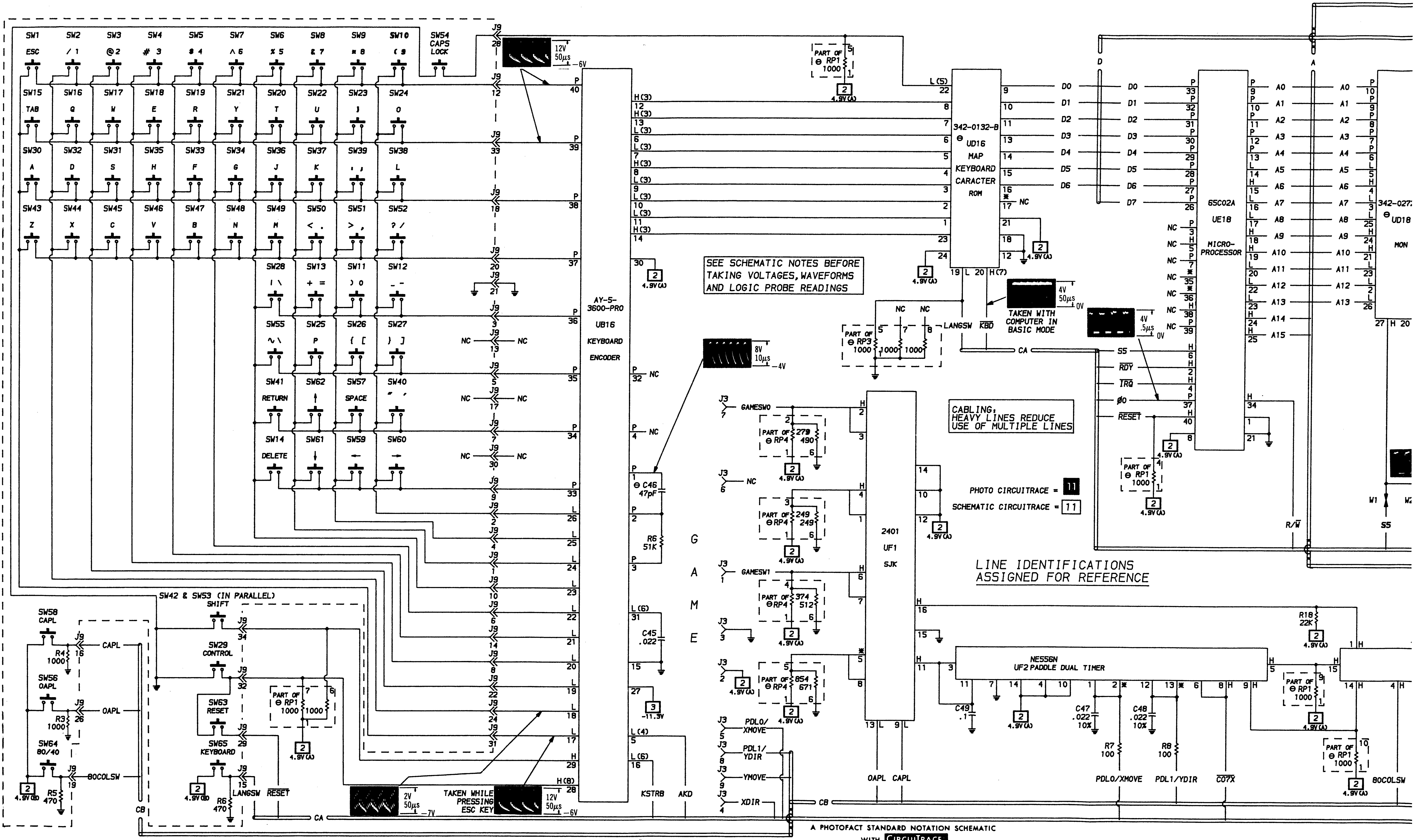
A Howard W. Sams GRIDTRACE™ Photo

MONITOR BOARD

A Howard W. Sams CIRCUITRACE® Photo


11.6V
3
11.8V
4
Q15
C B E
Q13
C E B
Q12
B C E
B
C Q11
E
IC701
E
Q17 C
B
E
C Q14
B
Q18
E
Q16 C
B
IC12
12.0V
1
42.0V
7
11.1V
2
431V
6
IC11
− 246V
5

ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED


SW1 ESC
SW2 / 1
SW3 @ 2
SW4 # 3
SW5 $ 4
SW7 ^ 6
SW6 % 5
SW8 & 7
SW9 * 8
SW10 (9
SW54 CAPS LOCK
SW15 TAB
SW16 Q
SW17 W
SW18 E
SW19 R
SW21 Y
SW20 T
SW22 U
SW23 I
SW24 O
SW30 A
SW32 D
SW31 S
SW35 H
SW33 F
SW34 G
SW36 J
SW37 K
SW39 ' ;
SW38 L
SW43 Z
SW44 X
SW45 C
SW46 V
SW47 B
SW48 N
SW49 M
SW50 < .
SW51 > ,
SW52 ? /
SW28 | \
SW13 + =
SW11) 0
SW12 _ -
SW55 ~ \
SW25 P
SW26 { [
SW27 }]
SW41 RETURN
SW62 ↑
SW57 SPACE
SW40 " '
SW14 DELETE
SW61 ↓
SW59 ←
SW60 →
SW42 & SW53 (IN PARALLEL) SHIFT
SW29 CONTROL
SW63 RESET
SW65 KEYBOARD
SW58 CAPL
SW56 OAPL
SW64 80/40
CAPL
OAPL
80COLSW
LANGSW
RESET
R4 1000
R3 1000
R5 470
R6 470
PART OF ⊖ RP1 1000
12V 50µs -6V
2V 50µs -7V
TAKEN WHILE PRESSING ESC KEY
12V 50µs -6V
AY-5-3600-PRO UB16 KEYBOARD ENCODER
⊖ C46 47pF
R6 51K
C45 .022
-11.3V
KSTRB
AKD
G A M E
8V 10µs -4V
SEE SCHEMATIC NOTES BEFORE TAKING VOLTAGES, WAVEFORMS AND LOGIC PROBE READINGS
342-0132-B ⊖ UD16 MAP KEYBOARD CARACTER ROM
PART OF ⊖ RP3 1000 1000 1000
LANGSW
KBD
CA
4V 50µs 0V
TAKEN WITH COMPUTER IN BASIC MODE
4V .5µs 0V
GAMESW0
GAMESW1
PART OF ⊖ RP4 279 490
PART OF ⊖ RP4 249 249
PART OF ⊖ RP4 374 512
PART OF ⊖ RP4 854 671
PDL0/XMOVE
PDL1/YDIR
YMOVE
XDIR
2401 UF1 SJK
OAPL CAPL
CABLING, HEAVY LINES REDUCE USE OF MULTIPLE LINES
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
LINE IDENTIFICATIONS ASSIGNED FOR REFERENCE
NE556N UF2 PADDLE DUAL TIMER
C49 .1
C47 .022 10%
C48 .022 10%
R7 100
R8 100
PDL0/XMOVE
PDL1/YDIR
C07X
R18 22K
80COLSW
CB
D0 D1 D2 D3 D4 D5 D6 D7
SS
RDY
IRQ
Ø0
RESET
65C02A UE18 MICRO-PROCESSOR
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15
R/W
342-027 ⊖ UD18 MON
W1
S5
4.9V(A)

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE

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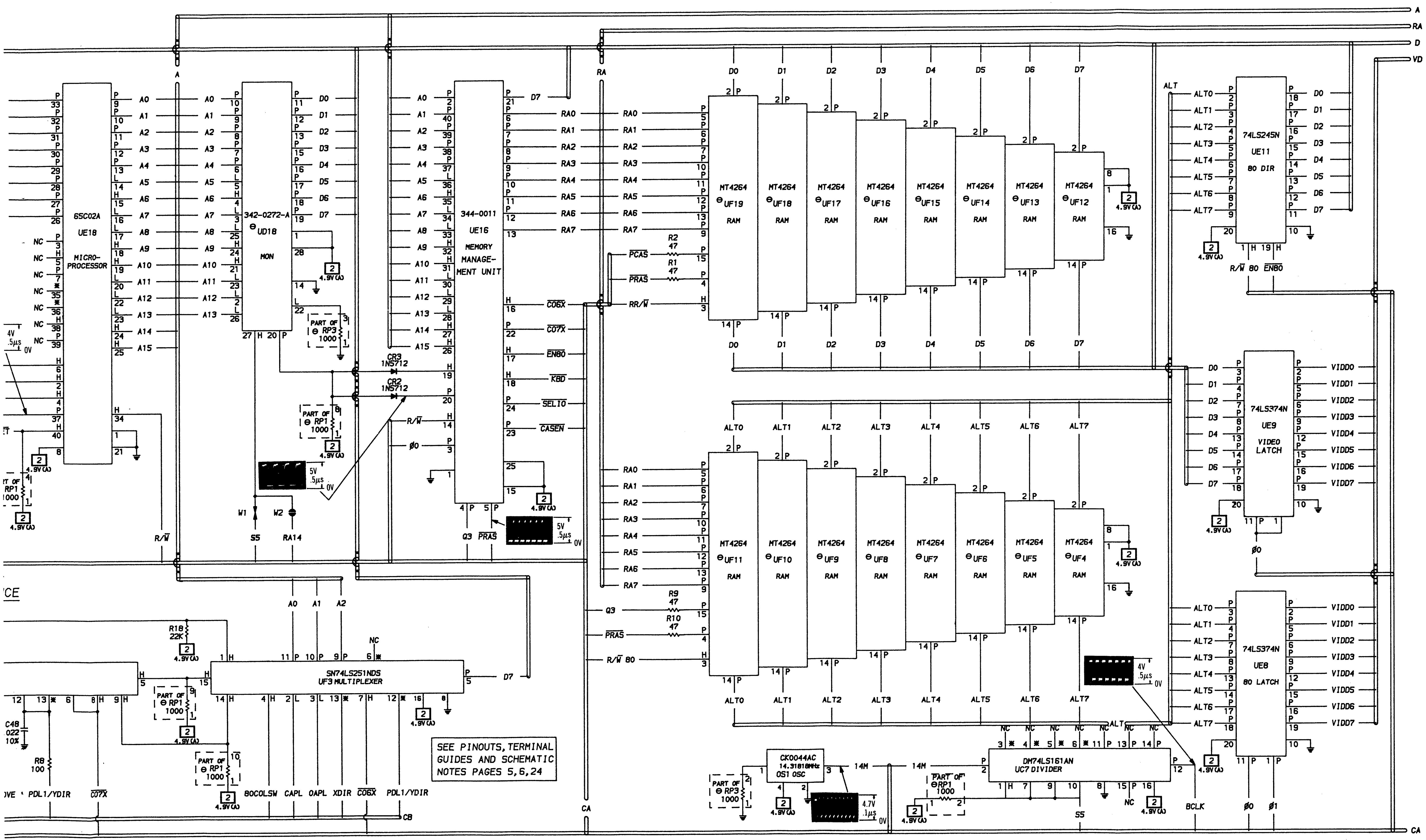
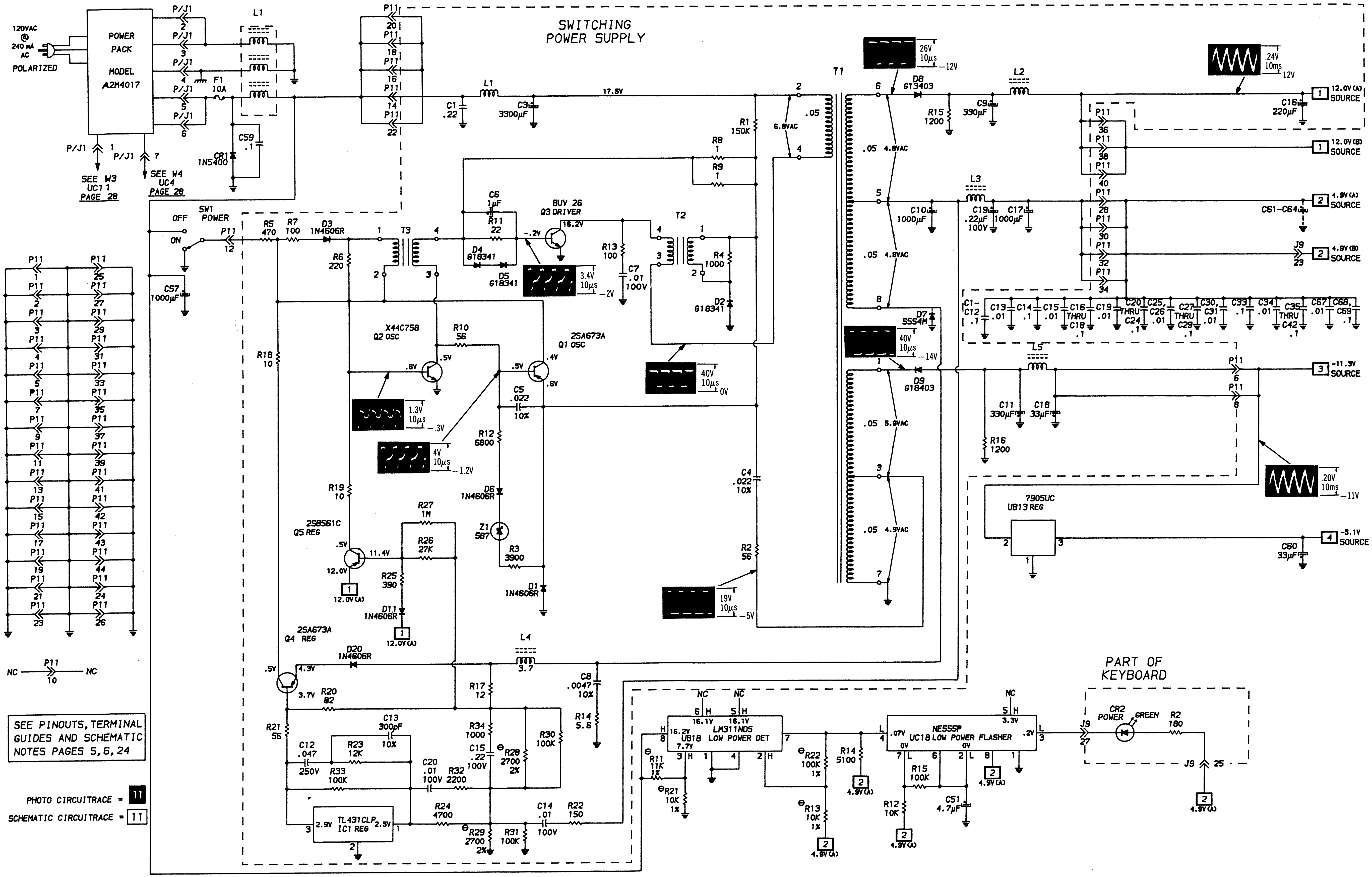
KEYBOARD


65C02A
UE18
MICRO-PROCESSOR
342-0272-A
UD18
MON
344-0011
UE16
MEMORY MANAGE-MENT UNIT
MT4264
UF19
UF18
UF17
UF16
UF15
UF14
UF13
UF12
UF11
UF10
UF9
UF8
UF7
UF6
UF5
UF4
RAM
74LS245N
UE11
80 DIR
74LS374N
UE9
VIDEO LATCH
74LS374N
UE8
80 LATCH
SN74LS251NDS
UF3 MULTIPLEXER
CK0044AC
14.31818MHz
OS1 OSC
DM74LS161AN
UC7 DIVIDER
CR3
1N5712
CR2
1N5712
R18
22K
R2
47
R1
47
R9
47
R10
47
R8
100
C48
.022
10%
PART OF RP1 1000
PART OF RP3 1000
W1
W2
S5
RA14
A
RA
D
VD
CA
CB
ALT
D7
RA0
RA1
RA2
RA3
RA4
RA5
RA6
RA7
PCAS
PRAS
RR/W
Q3
R/W 80
C06X
C07X
EN80
KBD
SELIO
CASEN
R/W
Ø0
Ø1
14M
BCLK
80COLSW
CAPL
OAPL
XDIR
PDL1/YDIR
VIDD0
VIDD1
VIDD2
VIDD3
VIDD4
VIDD5
VIDD6
VIDD7
4.9V (A)
5V .5µs 0V
4V .5µs 0V
4.7V .1µs 0V

SEE PINOUTS, TERMINAL GUIDES AND SCHEMATIC NOTES PAGES 5,6,24

SYSTEM BOARD

APPLE MODEL IIc


SWITCHING POWER SUPPLY
120VAC @ 240 mA AC POLARIZED
POWER PACK MODEL A2M4017
P/J1
L1
F1 10A
CR1 1N5400
C59 .1
SEE W3 UC1 1 PAGE 28
SEE W4 UC4 PAGE 28
SW1 POWER
OFF
ON
C57 1000µF
P11
C1 .22
C3 3300µF
17.5V
R5 470
R7 100
D3 1N4606R
R6 220
T3
C6 1µF
R11 22
D4 G18341
D5 G18341
BUV 26 Q3 DRIVER
16.2V
-.2V
3.4V 10µs -2V
R13 100
C7 .01 100V
T2
R4 1000
D2 G18341
40V 10µs 0V
R1 150K
R8 1
R9 1
6.8VAC
.05
T1
26V 10µs -12V
D8 G13403
L2
R15 1200
C9 330µF
C16 220µF
.24V 10ms 12V
12.0V(A) SOURCE
12.0V(B) SOURCE
4.8VAC
L3
C10 1000µF
C19 .22µF 100V
C17 1000µF
4.9V(A) SOURCE
C61-C64
4.9V(B) SOURCE
J9
D7 S5S4M
40V 10µs -14V
D9 G18403
L5
C11 330µF
C18 33µF
R16 1200
-11.3V SOURCE
.20V 10ms -11V
5.9VAC
4.9VAC
7905UC UB13 REG
C60 33µF
-5.1V SOURCE
C1-C12 .1
C13 .01
C14 .1
C15 .01
C16 THRU C18 .1
C19 .01
C20 THRU C24 .1
C25, C26 .01
C27 THRU C29 .1
C30, C31 .01
C33 .1
C34 .01
C35 THRU C42 .1
C67 .01
C68, C69 .1
X44C758 Q2 OSC
R10 56
2SA673A Q1 OSC
1.3V 10µs -.3V
4V 10µs -1.2V
C5 .022 10%
R12 6800
D6 1N4606R
Z1 5Z7
R3 3900
D1 1N4606R
R18 10
R19 10
2SB561C Q5 REG
11.4V
12.0V
R27 1M
R26 27K
R25 390
D11 1N4606R
12.0V(A)
2SA673A Q4 REG
D20 1N4606R
4.3V
3.7V
R20 82
L4 3.7
C8 .0047 10%
R17 12
R14 5.6
C4 .022 10%
R2 56
19V 10µs -5V
R21 56
C12 .047 250V
C13 300pF 10%
R23 12K
R33 100K
C20 .01 100V
R32 2200
R34 1000
C15 .22 100V
R28 2700 2%
R30 100K
TL431CLP IC1 REG
2.9V
2.5V
R24 4700
R29 2700 2%
R31 100K
C14 .01 100V
R22 150
NC
16.1V
LM311NDS UB18 LOW POWER DET
16.2V
7.7V
R11 11K 1%
R21 10K 1%
R22 100K 1%
R13 10K 1%
R14 5100
4.9V(A)
NE555P UC18 LOW POWER FLASHER
3.3V
.07V
.2V
0V
R15 100K
C51 4.7µF
R12 10K
PART OF KEYBOARD
CR2 POWER GREEN
R2 180
NC 10 NC

SEE PINOUTS, TERMINAL GUIDES AND SCHEMATIC NOTES PAGES 5, 6, 24

PHOTO CIRCUITRACE = 11

SCHEMATIC CIRCUITRACE = 11

A PHOTOFACT STANDARD NOTATION SCHEMATIC WITH CIRCUITRACE

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SWITCHING POWER SUPPLY

GENERAL OPERATING INSTRUCTIONS

POWER UP

The Computer will boot up automatically on any bootable diskette that is in the Disk Drive when turned On. If no diskette is in the Disk Drive when the Computer is turned On, the Computer will come up with "Apple IIc" and "Check Disk Drive" on the Monitor screen. Press the Control and Reset keys at the same time to put the Computer in Basic mode.

SWITCHING FROM BASIC TO MONITOR MODE

Type CALL-151 and press RETURN key. An asterisk will appear on the Monitor screen indicating the Computer is in the Monitor mode.

SWITCHING FROM MONITOR TO BASIC MODE

Press the CONTROL and C keys at the same time, then press the RETURN key (any Basic program already in memory, before going to the Monitor mode, will remain in memory).

Press the CONTROL and B keys at the same time, then press the RETURN key (any Basic program in memory will be lost).

RESET

Press the CONTROL and RESET keys at the same time to reset the Computer to Basic mode. Press the OPEN APPLE key (located on the left side of SPACE bar), CONTROL key and RESET key at the same time to reboot the system on any bootable diskette in the Disk Drive.

OPERATING THE DISK SYSTEM FROM BASIC MODE (DOS3.3)

Type CATALOG and press the RETURN Key to get a list of the programs which are on the diskette. Type CATALOG, D1 for Disk Drive 1 or CATALOG, D2 for Disk Drive 2 if the current Disk Drive is not the one desired.

Type LOAD and the program name, then press the RETURN key to load a program from the diskette.

Type SAVE and the program name, then press the RETURN key to save a program on the diskette.

BOOTING UP THE DISK OPERATING SYSTEM (DOS)

Insert a diskette containing a DOS into the Disk Drive and turn On the Computer. The Computer will automatically load the DOS and come up in Basic mode if DOS3.3 is used. If PRODOS is used the Computer will come up with menu of PRODOS features on the Monitor screen.

To boot from Basic mode, type PR#6 or 1N#6 and press the RETURN key. If there is no diskette in the Disk Drive, the Disk Drive will stop and the message "Check Disk Drive" will appear on the Monitor screen.

DOS can also be rebooted by pressing the OPEN APPLE key (located on left side of SPACE bar), CONTROL key and RESET key at the same time.

USING BLANK DISKETTES

A blank diskette must be initialized (DOS3.3) or Formatted (PRODOS) before it can be used to save data. To initialize a diskette using DOS3.3, boot the disk operating system from a diskette containing DOS3.3, remove the DOS3.3 diskette and put the blank diskette into the Disk Drive. Type INIT HELLO and press the RETURN key. The diskette will be initialized when the drive stops. NOTE: Any previous information on diskette will be over written and lost when initialized.

If PRODOS is being used, select the PRODOS FILER (press F key) from the menu that comes up when PRODOS is booted up. Select Volume Commands (press V key) from the second menu that comes up and then select Format A Volume (press F key) from the third menu that comes up. Insert the blank diskette into the Disk Drive and follow the instructions on the Monitor screen to format the diskette.

80/40 COLUMN SWITCH

This switch takes effect only if the program being used checks to see if the switch is down (40 column) or up (80 column). The program then automatically sets the 40 or 80 column mode according to the switch setting.

To select 80 column mode manually press the ESC key then press the 8 key or type PR#3 and press the Return key.

To select 40 column mode manually press the ESC key then press the Control and Q keys at the same time or type PR#0 and press the Return key.

DISASSEMBLY INSTRUCTIONS

CABINET REMOVAL

Turn the Computer upside down. Remove four screws from under the keyboard and two screws located in front of the handle. Turn the Computer right side up and extend the handle. Release the front latch tab. Lift the top front up and back to clear the rear panel.

DISK DRIVE REMOVAL

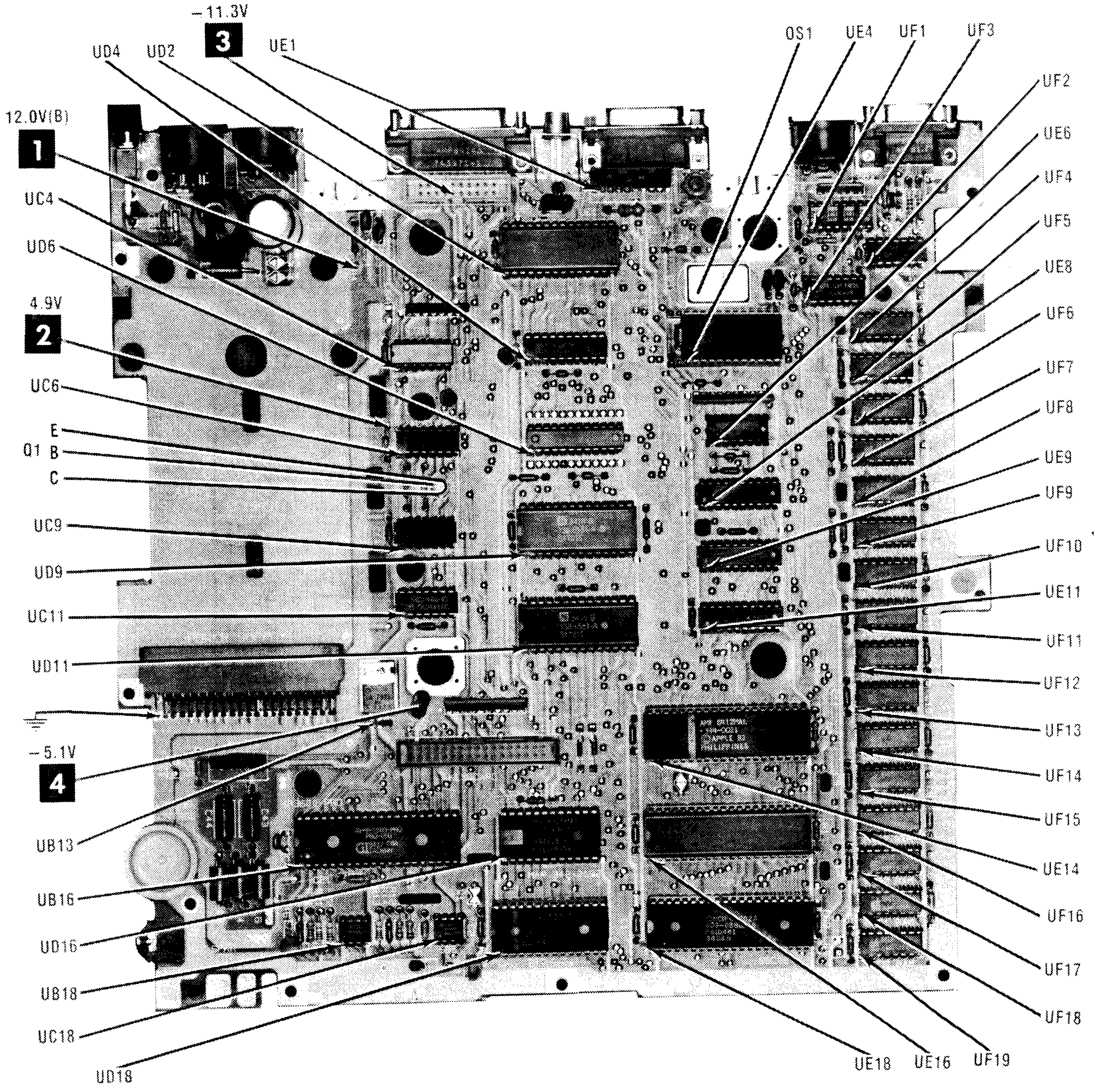
Remove four screws from cabinet bottom. Disconnect Disk Drive from System board and remove Disk Drive.

POWER SUPPLY REMOVAL

Remove two screws securing Switching Power Supply. Slide Switching Power Supply back and remove from Connector. To remove Switching Power Supply board from shield, remove the two screws near the edge connector and loosen the screw on the side of the shield. Slide the shield backward to free lock tabs and carefully separate from board.

SYSTEM BOARD REMOVAL

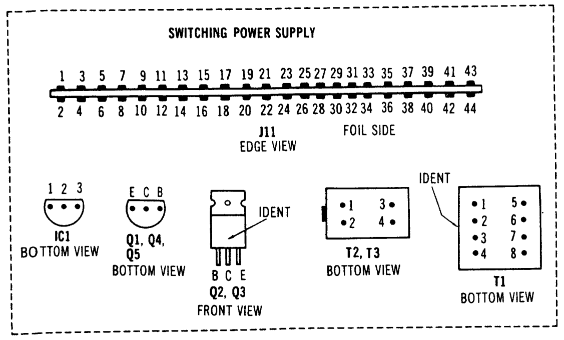
Disconnect the speaker. Remove nine screws holding System board and remove.



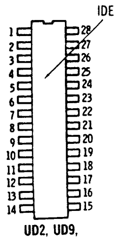
A Howard W. Sams CIRCUITRACE® Photo

IC PINOUTS & TERMINAL GUIDES

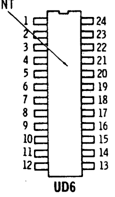
SWITCHING POWER SUPPLY


1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
FOIL SIDE
1 2 3
E C B
IDENT
B C E
1 2 3 4
1 2 3 4 5 6 7 8

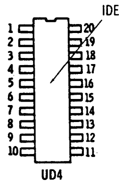
J11 EDGE VIEW
IC1 BOTTOM VIEW
Q1, Q4, Q5 BOTTOM VIEW
Q2, Q3 FRONT VIEW
T2, T3 BOTTOM VIEW
T1 BOTTOM VIEW


IDENT
1 2 3 4 5 6 7 8 9 10 11 12 13 14
28 27 26 25 24 23 22 21 20 19 18 17 16 15

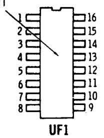
UD2, UD9, UD11, UD18 TOP VIEW


1 2 3 4 5 6 7 8 9 10 11 12
24 23 22 21 20 19 18 17 16 15 14 13

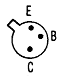
UD6 TOP VIEW


IDENT
1 2 3 4 5 6 7 8 9 10
20 19 18 17 16 15 14 13 12 11

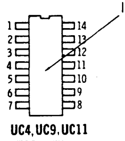
UD4 TOP VIEW


1 2 3 4 5 6 7 8
16 15 14 13 12 11 10 9

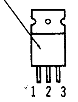
UF1 TOP VIEW



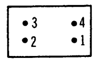
Q1 BOTTOM VIEW


IDENT
1 2 3 4 5 6 7
14 13 12 11 10 9 8

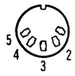
UC4, UC9, UC11 TOP VIEW



UB13 FRONT VIEW

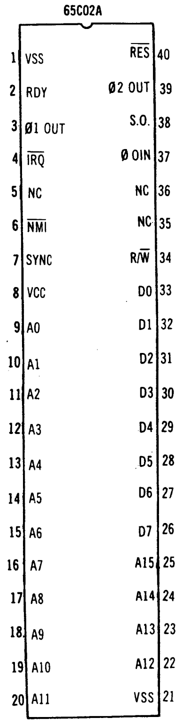


OS1 BOTTOM VIEW



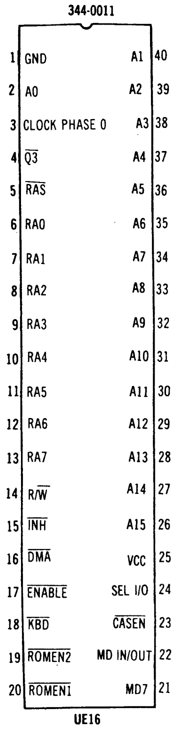
J6, J12 EXTERNAL VIEW

65C02A


1 VSS
2 RDY
3 Ø1 OUT
4 IRQ
5 NC
6 NMI
7 SYNC
8 VCC
9 A0
10 A1
11 A2
12 A3
13 A4
14 A5
15 A6
16 A7
17 A8
18 A9
19 A10
20 A11
RES 40
Ø2 OUT 39
S.O. 38
Ø 0IN 37
NC 36
NC 35
R/W 34
D0 33
D1 32
D2 31
D3 30
D4 29
D5 28
D6 27
D7 26
A15 25
A14 24
A13 23
A12 22
VSS 21

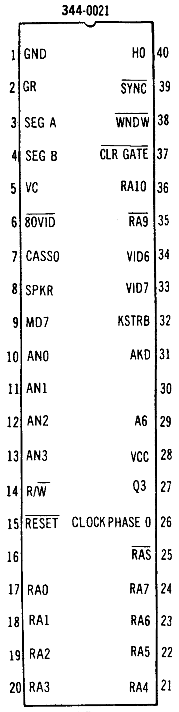
UE18 MICROPROCESSOR TOP VIEW

344-0011


1 GND
2 A0
3 CLOCK PHASE 0
4 Q3
5 RAS
6 RA0
7 RA1
8 RA2
9 RA3
10 RA4
11 RA5
12 RA6
13 RA7
14 R/W
15 INH
16 DMA
17 ENABLE
18 KBD
19 ROMEN2
20 ROMEN1
A1 40
A2 39
A3 38
A4 37
A5 36
A6 35
A7 34
A8 33
A9 32
A10 31
A11 30
A12 29
A13 28
A14 27
A15 26
VCC 25
SEL I/O 24
CASEN 23
MD IN/OUT 22
MD7 21

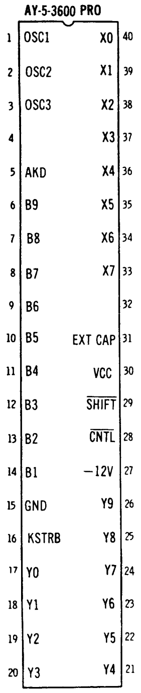
UE16 MEMORY MANAGMENT UNIT TOP VIEW

344-0021


1 GND
2 GR
3 SEG A
4 SEG B
5 VC
6 80VID
7 CASSO
8 SPKR
9 MD7
10 AN0
11 AN1
12 AN2
13 AN3
14 R/W
15 RESET
16
17 RA0
18 RA1
19 RA2
20 RA3
H0 40
SYNC 39
WNDW 38
CLR GATE 37
RA10 36
RA9 35
VID6 34
VID7 33
KSTRB 32
AKD 31
30
A6 29
VCC 28
Q3 27
CLOCK PHASE 0 26
RAS 25
RA7 24
RA6 23
RA5 22
RA4 21

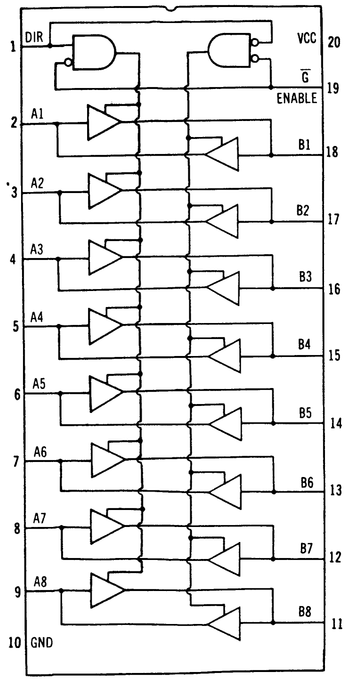
UE14 INPUT/OUTPUT UNIT TOP VIEW

AY-5-3600 PRO


1 OSC1
2 OSC2
3 OSC3
4
5 AKD
6 B9
7 B8
8 B7
9 B6
10 B5
11 B4
12 B3
13 B2
14 B1
15 GND
16 KSTRB
17 Y0
18 Y1
19 Y2
20 Y3
X0 40
X1 39
X2 38
X3 37
X4 36
X5 35
X6 34
X7 33
32
EXT CAP 31
VCC 30
SHIFT 29
CNTL 28
−12V 27
Y9 26
Y8 25
Y7 24
Y6 23
Y5 22
Y4 21

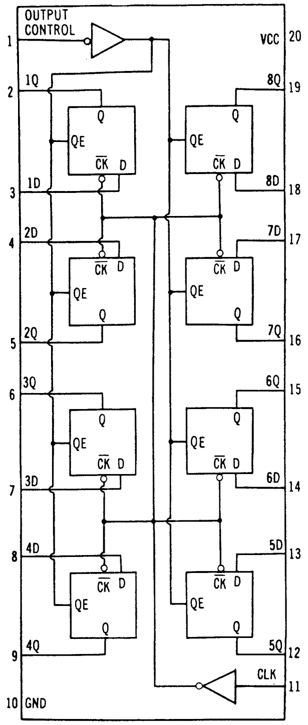
UB16 KEYBOARD ENCODER TOP VIEW

74LS245N

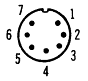

1 DIR
2 A1
3 A2
4 A3
5 A4
6 A5
7 A6
8 A7
9 A8
10 GND
VCC 20
G ENABLE 19
B1 18
B2 17
B3 16
B4 15
B5 14
B6 13
B7 12
B8 11

UE11 DIR TOP VIEW

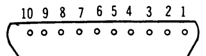
74LS374N


1 OUTPUT CONTROL
2 1Q
3 1D
4 2D
5 2Q
6 3Q
7 3D
8 4D
9 4Q
10 GND
VCC 20
8Q 19
8D 18
7D 17
7Q 16
6Q 15
6D 14
5D 13
5Q 12
CLK 11
Q
QE
CK
D

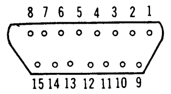
UE8, UE9 LATCH/VIDEO LATCH TOP VIEW



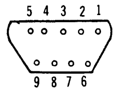
J1 EXTERNAL VIEW


10 9 8 7 6 5 4 3 2 1
19 18 17 16 15 14 13 12 11

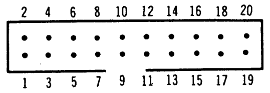
J2 EXTERNAL VIEW


8 7 6 5 4 3 2 1
15 14 13 12 11 10 9

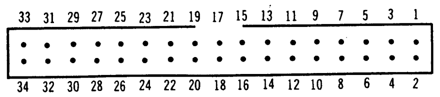
J5 EXTERNAL VIEW



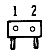
J3 EXTERNAL VIEW


2 4 6 8 10 12 14 16 18 20
1 3 5 7 9 11 13 15 17 19

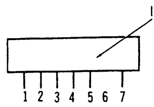
J8 PIN VIEW


33 31 29 27 25 23 21 19 17 15 13 11 9 7 5 3 1
34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2

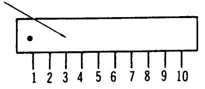
J9 PIN VIEW



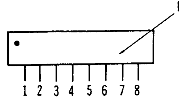
J10 WIRING VIEW


IDENT
1 2 3 4 5 6 7

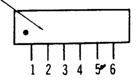
UA14 FRONT VIEW


1 2 3 4 5 6 7 8 9 10

UE1, RP1, RP2 FRONT VIEW

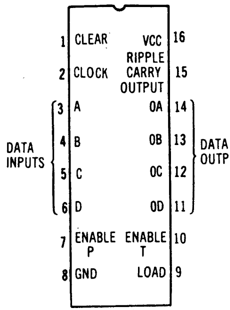

IDENT
1 2 3 4 5 6 7 8

RP3 FRONT VIEW



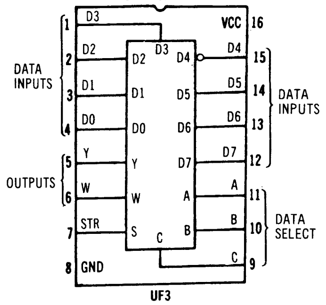
RP4 FRONT VIEW

DM74LS161AN


1 CLEAR
2 CLOCK
3 A
4 B
5 C
6 D
7 ENABLE P
8 GND
VCC 16
RIPPLE CARRY OUTPUT 15
QA 14
QB 13
QC 12
QD 11
ENABLE T 10
LOAD 9
DATA INPUTS
DATA OUTPUTS

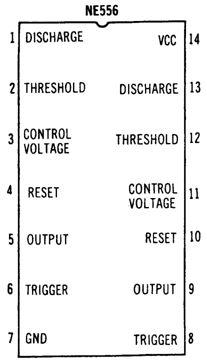
UC7 DIVIDER TOP VIEW

SN74LS251NDS


1 D3
2 D2
3 D1
4 D0
5 Y
6 W
7 STR
8 GND
VCC 16
D4 15
D5 14
D6 13
D7 12
A 11
B 10
C 9
DATA INPUTS
OUTPUTS
DATA INPUTS
DATA SELECT

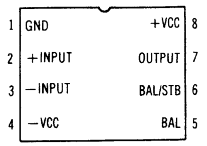
UF3 MULTIPLEXER TOP VIEW

NE556


1 DISCHARGE
2 THRESHOLD
3 CONTROL VOLTAGE
4 RESET
5 OUTPUT
6 TRIGGER
7 GND
VCC 14
DISCHARGE 13
THRESHOLD 12
CONTROL VOLTAGE 11
RESET 10
OUTPUT 9
TRIGGER 8

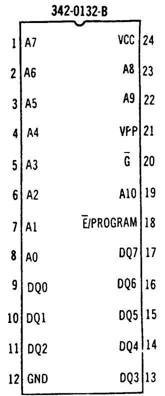
UF2 PADDLE DUAL TIMER TOP VIEW

LM311


1 GND
2 +INPUT
3 −INPUT
4 −VCC
+VCC 8
OUTPUT 7
BAL/STB 6
BAL 5

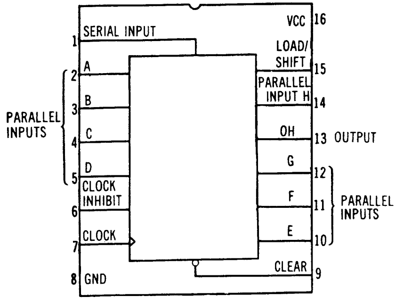
UB18 LOW POWER DETECTOR TOP VIEW

342-0132-B


1 A7
2 A6
3 A5
4 A4
5 A3
6 A2
7 A1
8 A0
9 DQ0
10 DQ1
11 DQ2
12 GND
VCC 24
A8 23
A9 22
VPP 21
G 20
A10 19
E/PROGRAM 18
DQ7 17
DQ6 16
DQ5 15
DQ4 14
DQ3 13

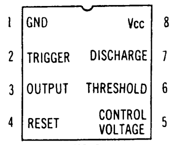
UD16 MAP KEYBOARD CHARACTER ROM TOP VIEW

SN74LS166AN


1 SERIAL INPUT
2 A
3 B
4 C
5 D
6 CLOCK INHIBIT
7 CLOCK
8 GND
VCC 16
LOAD/SHIFT 15
PARALLEL INPUT H 14
OH 13 OUTPUT
G 12
F 11
E 10
CLEAR 9
PARALLEL INPUTS
PARALLEL INPUTS

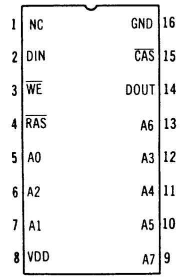
UE6 SPI TOP VIEW

NE555N


1 GND
2 TRIGGER
3 OUTPUT
4 RESET
Vcc 8
DISCHARGE 7
THRESHOLD 6
CONTROL VOLTAGE 5

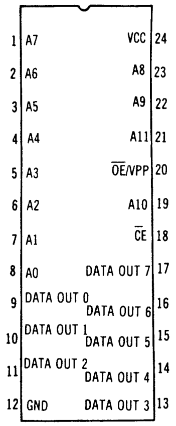
UC18 LOW POWER FLASHER TOP VIEW

MT4264


1 NC
2 DIN
3 WE
4 RAS
5 A0
6 A2
7 A1
8 VDD
GND 16
CAS 15
DOUT 14
A6 13
A3 12
A4 11
A5 10
A7 9

UF4, THRU UF19 RAM TOP VIEW

342-0265A


1 A7
2 A6
3 A5
4 A4
5 A3
6 A2
7 A1
8 A0
9 DATA OUT 0
10 DATA OUT 1
11 DATA OUT 2
12 GND
VCC 24
A8 23
A9 22
A11 21
OE/VPP 20
A10 19
CE 18
DATA OUT 7 17
DATA OUT 6 16
DATA OUT 5 15
DATA OUT 4 14
DATA OUT 3 13

UE4 CHARACTER GENERATOR TOP VIEW

SAFETY PRECAUTIONS

1. Use an isolation transformer for servicing.
2. Maintain AC line voltage at rated input.
3. Remove AC power from the Computer system before servicing or installing electrostatically sensitive devices. Examples of typical ES devices are integrated circuits and semiconductor "chip" components.
4. Use extreme caution when handling the printed circuit boards. Some semiconductor devices can be damaged easily by static electricity. Drain off any electrostatic charge on your body by touching a known earth ground. Wear a commercially available discharging wrist strap device. This should be removed prior to applying power to the unit under test.
5. Use a grounded-tip, low voltage soldering iron.
6. Use an isolation (times 10) probe on scope.
7. Do not remove or install boards, floppy disk drives, printers, or other peripherals with Computer system AC power On.
8. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.
9. This Computer system is equipped with a grounded three-pronged AC plug. This plug must fit into a grounded AC power outlet. Do not defeat the AC plug safety feature.
10. Periodically examine the AC power cord for damaged or cracked insulation.
11. The Computer system cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.
12. Instructions should be given, especially to children, that objects should not be dropped or pushed into the vents of the cabinet. This could cause shock or equipment damage.
13. Never expose the Computer system to water. If exposed to water turn the unit off. Do not place the Computer system near possible water sources.
14. Never leave the Computer system unattended or plugged into the AC outlet for long periods of time. Remove AC plug from AC outlet during lightning storms.
15. Do not allow anything to rest on AC power cord.
16. Unplug AC power cord from outlet before cleaning Computer system.
17. Never use liquids or aerosols directly on the Computer system. Spray on cloth and then apply to the Computer system cabinet. Make sure the Computer system is disconnected from the AC power line.

SCHEMATIC NOTES

—✱—Circuitry not used in some versions
---Circuitry used in some versions
⊖ See parts list
⏚ Ground
⫨ Chassis

Waveforms and voltages taken from ground, unless noted otherwise

Voltages, logic readings and waveforms taken in Power Up mode, Caps Lock and 80/40 Column keys down, Keyboard Switch up, no diskette in the Disk Drive "Apple IIc" and "Check Disk Drive" displayed on the Monitor screen.

(1) Probe indicates H if diskette is write protected or Head Position is operating.
(2) Probe indicates P when Head Position motor is operating.
(3) Readings taken after pressing Space Bar on keyboard.
(4) Probe indicates H when any key pressed except Control, Shift, Open Apple, Closed Apple and Reset keys.
(5) Probe indicates H when Caps Lock key is up.
(6) Probe indicates P when any key pressed except Control, Shift, Open Apple, Closed Apple and Reset keys.
(7) Probe indicates P when Computer is in "Basic" mode.
(8) Probe indicates L when the Control key is pressed.

Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on 0 reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7 cm. width with DC reference voltage given at the bottom line of each waveform.

Time in μsec. per cm, given with p-p reading at the end of each waveform.

Item numbers in rectangles appear in the alignment/adjustment instructions.

Supply voltages maintained as shown at input.

Controls adjusted for normal operation.

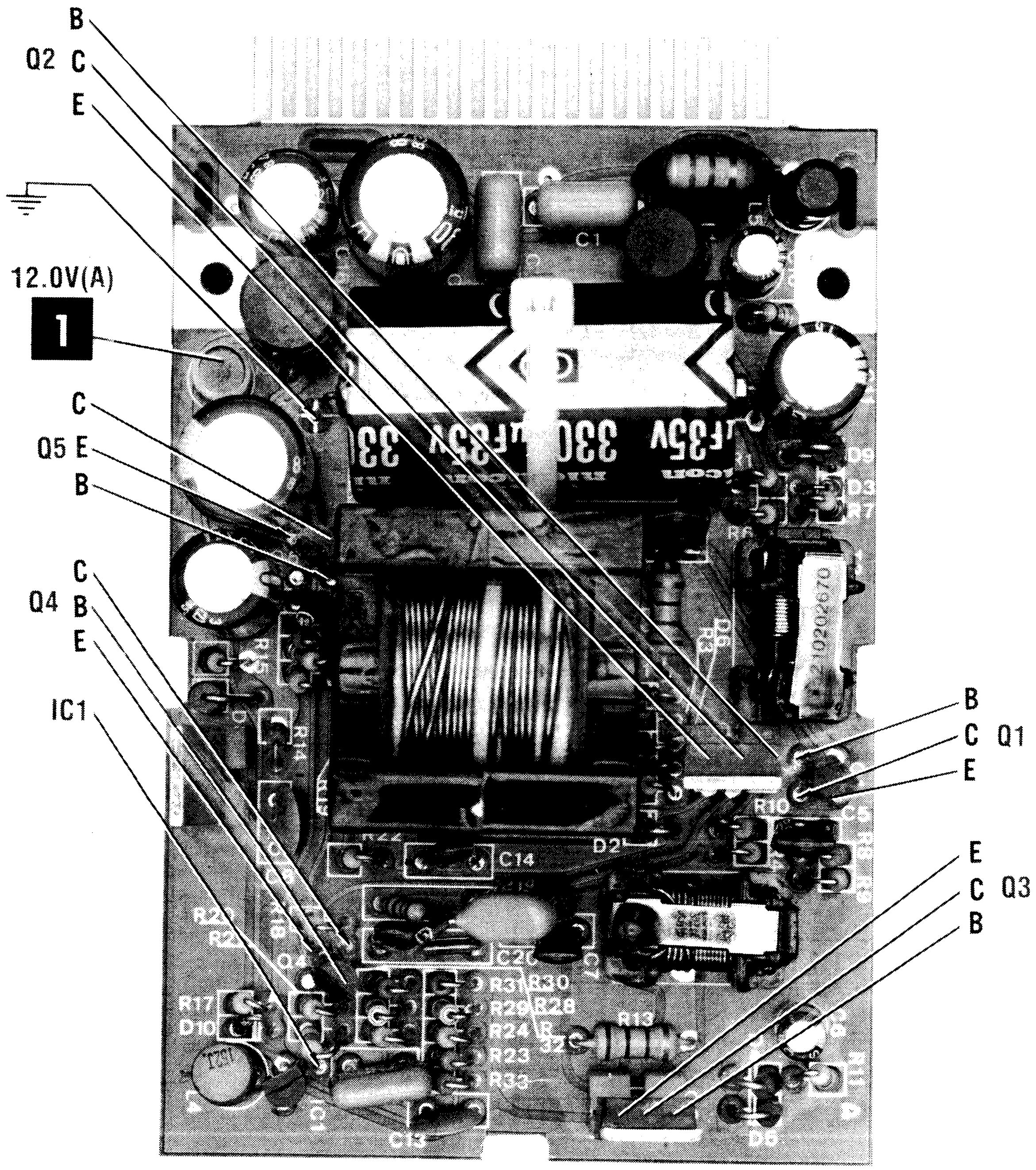
Terminal identification may not be found on unit.

Capacitors are 50 volts or less, 5% unless noted.

Electrolytic capacitors are 50 volts or less, 20% unless noted.

Resistors are ½W or less, 5% unless noted.

Value in ( ) used in some versions.



ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

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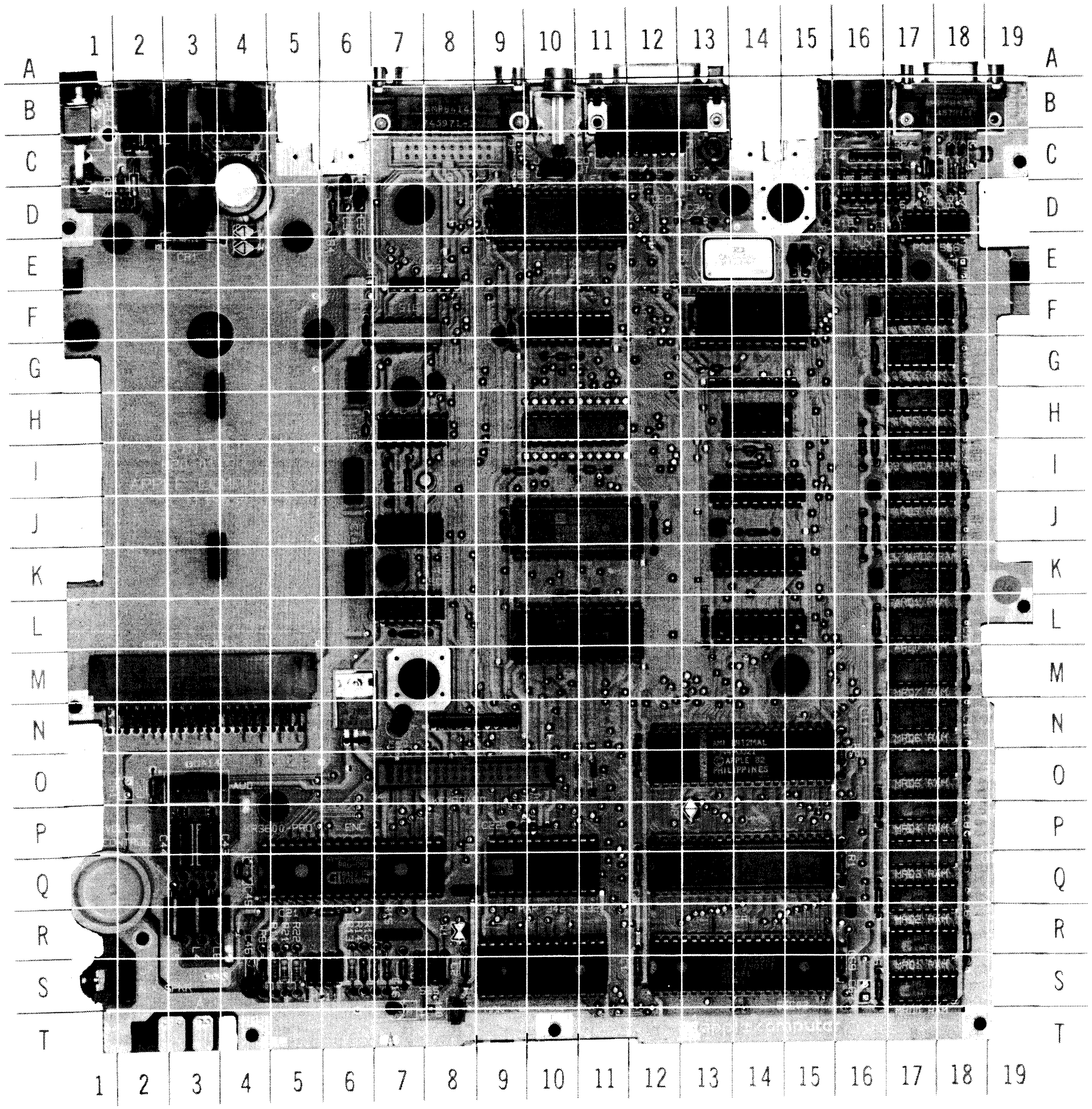
SWITCHING POWER SUPPLY BOARD



SYSTEM BOARD

A Howard W. Sams GRIDTRACE™ Photo

SYSTEM BOARD

SYSTEM BOARD GridTrace LOCATION GUIDE

C1	S-12
C2	S-8
C3	Q-12
C4	O-12
C5	S-16
C6	R-18
C7	Q-16
C8	Q-18
C9	P-16
C10	O-18
C11	N-16
C12	M-18
C13	G-10
C14	J-6
C15	I-11
C16	S-7
C17	L-7
C18	K-9
C19	H-6
C20	F-6
C21	R-6
C22	P-10
C23	O-2
C25	E-15
C27	L-13
C28	I-14
C29	J-14
C30	G-13
C31	I-14
C33	J-9
C34	D-13
C35	L-16
C36	K-18
C37	J-16
C38	I-18
C39	I-16
C40	H-18
C41	G-16
C42	F-18
C43	P-3
C44	P-3
C45	Q-4
C46	S-4
C47	C-17
C48	C-18
C49	C-17
C51	T-7
C53	D-6
C54	D-6
C55	E-15
C56	E-15
C57	C-4
C59	C-2
C60	N-7
C65	C-10
C67	F-9
C68	I-9
C69	S-16
CR1	E-3
CR2	O-11
CR3	O-10
F1	D-2
J1	B-2
J2	B-8
J3	B-18
J4	B-10
J5	B-12
J6	B-4
J7	S-1
J8	C-8
J9	O-8
J10	T-8
J11	M-3
J12	B-16
L1	C-3
L2	C-13
L3	C-12
L4	R-3
L5	R-3
L6	R-3
OS1	E-14
Q1	I-8
R1	Q-16
R2	O-16
R3	Q-1
R4	D-6
R5	D-15
R6	S-4
R7	C-18
R8	C-18
R9	J-16
R10	I-16
R11	S-5
R12	S-7
R13	S-6
R14	S-6
R15	S-7
R16	J-12
R18	D-16
R19	I-7
R20	I-7
R21	S-5
R22	S-5
RP1	N-8
RP2	G-14
RP3	F-7
RP4	C-16
S1	B-1
UA14	O-3
UB13	N-6
UB16	Q-6
UB18	S-6
UC4	F-7
UC6	H-7
UC10	J-7
UC11	L-7
UC18	S-8
UD2	D-10
UD4	F-10
UD6	H-10
UD9	J-10
UD11	L-10
UD16	Q-10
UD18	S-10
UE1	C-12
UE4	F-14
UE6	H-14
UE8	I-14
UE9	K-14
UE11	L-14
UE14	O-14
UE16	Q-14
UE18	S-14
UF1	D-16
UF2	D-17
UF3	E-16
UF4	F-17
UF5	G-17
UF6	H-17
UF7	I-17
UF8	I-17
UF9	J-17
UF10	K-17
UF11	L-17
UF12	M-17
UF13	N-17
UF14	O-17
UF15	P-17
UF16	Q-17
UF17	Q-17
UF18	R-17
UF19	S-17

TEST EQUIPMENT

Test Equipment listed by Manufacturer illustrates typical or equivalent equipment used by SAMS' Engineers to obtain measurements and is compatible with most types used by field service technicians.

Equipment Name	B & K Precision Equipment No.	Simpson Equipment No.	
OSCILLOSCOPE	1570A,1590A,1596	454	
LOGIC PROBE	DP51		
LOGIC PULSER	DP101		
DIGITAL VOM	2830	463,467,470,474	
ANALOG VOM	277	260-7	
ISOLATION TRANSFORMER	TR110,1604,1653,1655		
FREQUENCY COUNTER	1803,1805	710	
COLOR BAR GENERATOR	1211A,1248,1251,1260	431	
RGB GENERATOR	1260		
FUNCTION GENERATOR	3020	420A,420D	
HI-VOLTAGE PROBE	HV-44	248	
TEMPERATURE PROBE	TP-28	IR-10	
CRT ANALYZER	467,470		

TROUBLESHOOTING

COMPUTER DEAD

No display on the Monitor screen when the Computer is turned On. Verify the green Power LED (CR2) is On. If the LED is not On, refer to the "Power Supply" section of this Troubleshooting guide. If the LED is On, turn the speaker volume control (on left side of the Computer) up and listen for a beep when the Computer is turned On or when the Control and Reset keys are pressed at the same time. If a beep is heard check the cable going to the Monitor and check the Monitor. If the cable and Monitor check good, refer to the "Video" section of this Troubleshooting guide. If no beep is heard refer to the "Microprocessor (CPU) Operation" section of this Troubleshooting guide.

POWER SUPPLY

Computer dead, Power LED not On. Unplug the Power Pack Plug (P1) from the Computer and check for 18.2V from pin 2 to pin 6 of Plug P1. If 18.2V is missing repair or replace the Power Pack. If 18.2V is present plug the Power Pack back into the Computer (with Computer Off) and check for 17.5V at pin 2 of Switching Transformer (T1). If 17.5V is missing check Fuse F1 and Coil L1 on the System board, and Coil L1 on the Switching Power Supply board. Check Connectors J1 and P11 for good connections. If Fuse F1 is bad, unplug the Power Pack and check for a possible short to ground at pin 2 of Transformer T1. If pin 2 of Transformer T1 checks shorted to ground check Diode CR1 and Capacitors C57 and C59 on the System board and check Capacitors C1 and C3 and Driver Transistor Q3 on the Switching Power Supply board.

If 17.5V is present at pin 2 of Transformer T1, turn the Computer On and verify the power supply is oscillating by checking the waveform at the Base of Transistor Q3. If the power supply is not oscillating, check the On-Off Switch (S1) and check pin 12 of Connector P11 for good connection. Also check the voltages and components associated with the Oscillator Transistors (Q1 and Q2), Driver Transistor (Q3) and Regulator Transistors (Q4 and Q5) and check for possible shorts to ground at pins 1, 3, 5, 6 and 8 of Transformer T1.

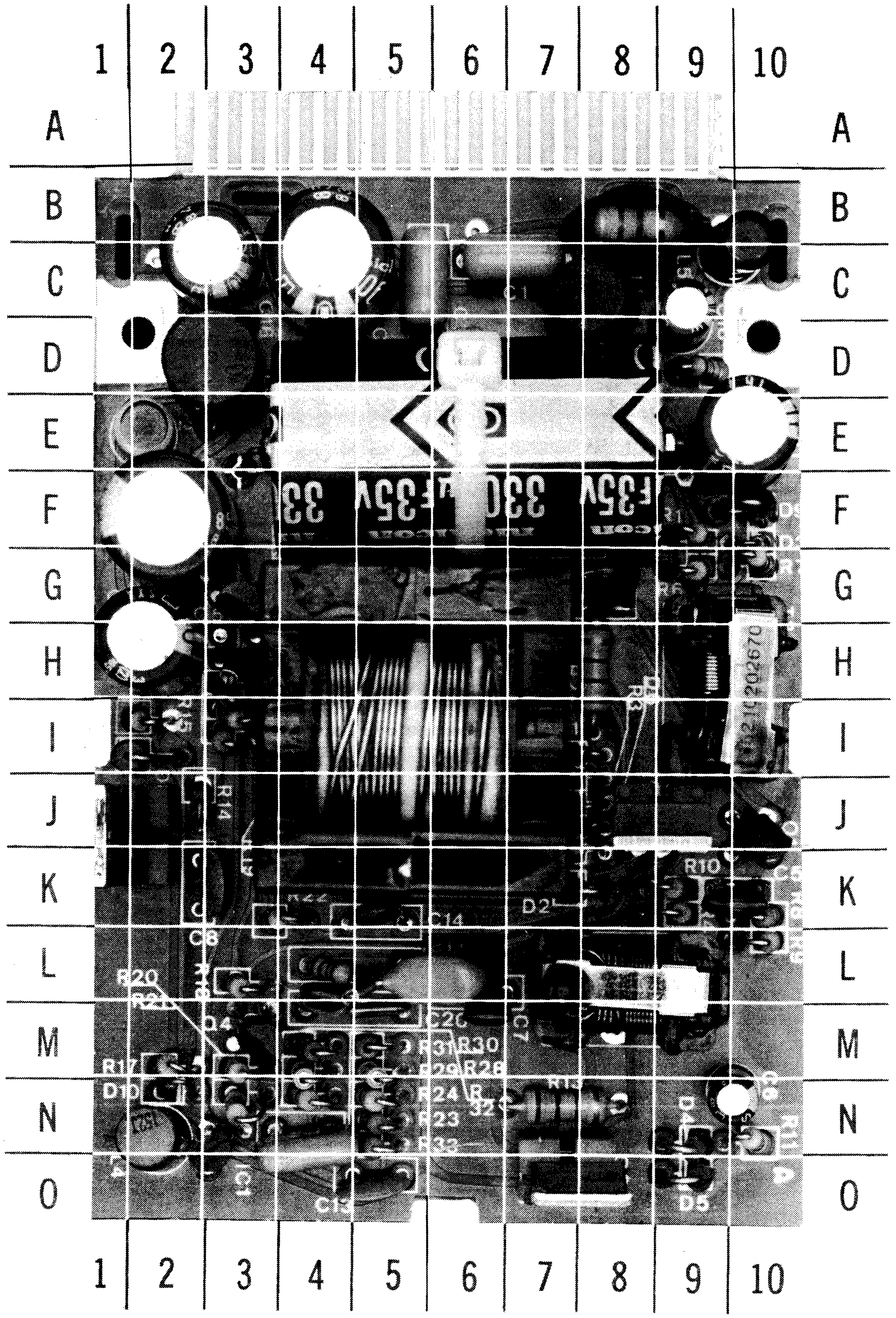
If the power supply is oscillating, but the output source voltages are not correct (12V at pin 36, 4.9V at pin 28 and −11.3V at pin 6 of Connector P11) check the voltages and components associated with the Regulator IC (IC1) and Transistors Q4 and Q5.

MICROPROCESSOR (CPU) OPERATION

Computer is not working and power supply is normal, check the logic reading on pin 40 of the Microprocessor IC (UE18) while turning the Computer On. The logic reading should be Low then change to High. The logic reading is Low as long as the Control and Reset keys are held down. If the logic reading is not correct when turning the Computer On check the Input/Output Unit IC (UE14). If the logic reading does not read Low when the Control and Reset keys are held down check pins 29 and 21 of Connector J9 for good connections and check the Control and Reset keys for continuity when pressed.

If the reset circuit is working, check the 14.318MHz clock waveform at pin 1 of the GLU IC (UD6) if the waveform is missing check the 1K resistor from pin 1 to 2 of Resistor pack RP3 and check the Oscillator Module (OS1). If the 14.31818MHz waveform is present check the 7.159MHz waveform at pin 2 of the TMG IC (UD4), 3.5795MHz waveform at pin 3 of IC UD4 and 1.02MHz waveform at pins 14 and 15 of IC UD4. If any of the waveforms are missing check IC UD4. Check for a High logic reading at pins 2, 4 and 6 of Microprocessor IC (UE18). If any of the readings are not correct check the components and IC's connected to the pin with the incorrect reading and check IC UE18.

If IC UE18 checks good check the MON IC (UD18), Memory Management Unit IC (UE16), Input/Output Unit IC (UE14) and RAM IC's (UF12 thru UF19).



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SWITCHING POWER SUPPLY BOARD

LINE DEFINITIONS

A0 Thru A15	Address Lines
AKD	Any Key Down
ALTVID	Alternate Video
AN0 Thru AN3	Annunciator 0 Thru 3
CASEN	Cassette Enable
CAPL	Closed Apple Control Line
CAPLOCK	Capital (Letter) Lock
CLKEN	Clock Enable
CLRGATE	Color Burst Gate
CNTL	Control
COXX	Hex Addresses
CO6X, CO7X	Hex Addresses
CXXX	Hex Addresses
DMA	Direct Memory Access
D0 Thru D7	Data Lines
DEV1 Thru DEV7	Peripheral Device Select
ENABLE1, ENABLE2	Enable
ENKBD	Enable Keyboard
ENTMG	Enable Master Timing
ENVID	Enable Video
EN80	Enable Auxiliary RAM
EXTINT	External Interrupt
FRCTXT	
GR	Graphics
H0	Horizontal 0
I/OSTROBE	Input/Output Strobe
INH	Inhibits Main Memory
IOSEL	Input/Output Select
IRQ	Input Request
IWM	Integrated Woz Machine (Disk Drive I/O)
KBD	Keyboard
KSTRB	Keyboard Strobe
LANGSW	Keyboard Switch Line
LDPS	Load Parallel to Serial
MD0 Thru MD7	Main Data Lines
MD IN/OUT	Buffered Data Input/Output
MOTOR ON	Motor On
MR	Memory Read
NMI	Non-Maskable Interrupt
OAPL	Open Apple Control Line
PDL0 Thru PDL3	Game Paddle Lines
PCAS	Phase 0 Column Address Strobe
PRAS	Phase 0 Row Address Strobe
Q3	General Purpose Clock
RA0 Thru RA7, RA9, RA10	Multiplexed Address Lines
RDY	Ready
RESET	Reset
READ DATA	Read Data
ROMEN1, ROMEN2	ROM Enable Lines
R/W	Read/Write
R/W80	Read/Write 80 Character
SEGA	Segment A
SEGB	Segment B
SEROUT	Serial Output
SHFT	Shift
SPKR	Speaker
STB	Strobe
SW0/OAPL	Switch 0/Open Apple
SW1/CAPL	Switch 1/Closed Apple
SW2	Switch 2
SYNC	Sync
VC	Vertical Counter
VID0 Thru VID7	Video Data 0 Thru 7
VID7M	Video 7 MHz
WNDW	Window
WRITE DATA	Write Data
WRITE PROTECT	Write Protect
WRITE REQ	Write Request
X0 Thru X7	Keyboard Matrix
Y0 Thru Y9	Keyboard Matrix
3.58M	3.58MHz
7M	7MHz
14M	14MHz
80VID	80 Character Video
μPSYNC	Microprocessor Sync
Ø0	Phase 0
Ø1	Phase One
ØA	Phase A
ØB	Phase B
ØC	Phase C
ØD	Phase D

Any Bar above any alphabetical or numerical combination indicates line active in a low (0) state.

SWITCHING POWER SUPPLY BOARD GridTrace LOCATION GUIDE

C1	C-7	C18	C-9	L2	E-2	R7	G-10	R23	N-5
C3	E-6	C19	C-5	L3	D-3	R8	K-10	R25	H-3
C4	G-8	C20	L-4	L4	N-2	R9	L-10	R26	H-3
C5	K-10	D1	I-7	L5	B-10	R10	K-9	R27	I-3
C6	N-10	D2	K-7	P11	A-6	R11	N-10	R28	M-4
C7	M-6	D3	F-10	Q1	J-10	R12	J-7	R29	M-5
C8	K-3	D4	N-9	Q2	J-9	R13	N-7	R30	M-4
C9	H-2	D5	O-9	Q3	O-8	R14	J-2	R31	M-5
C10	F-2	D6	J-8	Q4	M-3	R15	I-2	R32	N-4
C11	E-10	D7	J-2	Q5	G-3	R16	D-9	R33	N-5
C12	N-4	D8	I-2	R1	F-9	R17	M-2	R34	L-4
C13	O-5	D9	F-10	R2	H-8	R18	L-3	T1	I-5
C14	K-5	D10	N-2	R3	J-7	R19	I-3	T2	L-8
C15	L-6	D11	H-3	R4	K-9	R20	M-3	T3	H-10
C16	C-2	IC1	N-3	R5	B-8	R21	N-3	Z1	J-7
C17	C-4	L1	C-8	R6	G-9	R22	K-4		

TROUBLESHOOTING (Continued)

KEYBOARD

Keyboard is dead or has no response when a key is pressed. Check Connector J9 and the keyboard cable for good connections. Check for −11.3V at pin 27 of the ENC (keyboard encoder) IC (UB16). If −11.3V is missing refer to the "Power Supply" section of this Troubleshooting guide. If −11.3V is present, check the waveform at pin 1 of IC UB16. If the waveform is missing, check Capacitor C46, Resistor R6 and IC UB16. If the waveform is present at pin 1 of IC UB16, check the waveforms on pins 17 thru 26 and 33 thru 40 of IC UB16. The waveforms on pins 17 thru 26 should look similar to the waveform shown on pin 18 with no key pressed and should look similar to the waveform shown on pin 17 when any key connected to the pin being checked is pressed. The waveforms on pins 33 thru 40 should look similar to the waveform shown on pin 40 of IC UB16. If any waveform is missing check IC UB16. If the waveforms on pins 17 thru 26 do not change when a key connected to the pin being checked is pressed check the key for continuity when pressed.

Check for the waveform shown in Figure 6 at pins 17 thru 26 of IC UB16 when any key is pressed repeatedly except the Control Shift, Open Apple, Closed Apple and Reset keys. If the waveform is missing check Capacitor C45 and IC UB16.

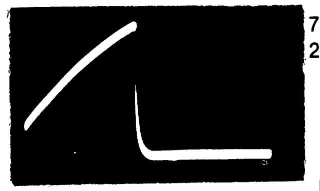


Figure 6

Check the logic readings on pins 5 and 16 of IC UB16. Pin 5 logic reading should be High and pin 16 should read a Pulse when any key is pressed except the Control, Shift, Open Apple, Closed Apple and Reset keys. If either reading is not correct, check IC UB16.

Check the logic readings on pins 6 thru 14 of IC UB16 after pressing the Space Bar. (See logic readings on schematic). If any of the readings are not correct, check IC UB16.

Press the Control and Reset keys to put the Computer in "Basic" mode and check for Pulses at pin 20 of the MAP (Keyboard Character ROM) IC (UD16). If pulses are missing check Memory Management Unit IC (UE16). If pulses are present at pin 20 of IC UD16 and all the previous checks are good, check IC UD16, UE14 and UD9.

If only one key does not work, check the solder connection on the defective key and check the key for continuity when the key is pressed.

If a wrong character appears on the Monitor screen when a key is pressed, check IC's UD16 and UE16.

If a character does not repeat when a key is held down check IC UE14.

If a character appears more than once on the Monitor screen when a key is pressed momentarily, check Capacitor C45 and IC UB16.

If any group of keys do not work, check the Keyboard cable and Connector J9 for good connections and check IC UB16.

DISK DRIVE INTERFACE

Disk Drive Interface circuit does not work. Turn the Computer Off and disconnect the Disk Drives from the Computer. Turn the Computer On, in Basic mode (See General Operating Instructions). Type in and run the following Basic program and make all tests while the program is running. Press the Control and Reset keys to stop the program.

```
 10 X = PEEK (− 16151)
 20 X = PEEK (− 16150)
 30 X = PEEK (− 16148)
 40 X = PEEK (− 16146)
 50 X = PEEK (− 16145)
 60 X = PEEK (− 16147)
 70 FOR Y = − 16153 TO  − 16160 STEP-1
 80 X = PEEK (Y)
 90 NEXT Y
100 GOTO 20
```

Check for pulses at pin 7 of the Disk Controller IC (UD2). If pulses are missing, check IC UD6. If pulses are present at pin 7 of IC UD2, check for pulses at pins 1, 2, 8, 9, 27 and 28 of IC UD2. If pulses are missing at any of the pins check IC UD2.

To check the read data circuit, insert a diskette containing data in the Disk Drive. Type in and run the following Basic program.

```
10 X = PEEK (− 16151)
20 X = PEEK (− 16150)
30 X = PEEK (− 16148)
40 X = PEEK (− 16146)
```

Check for data pulses at pin 22 of Disk Controller IC (UD2). If data pulses are present at pin 22 of IC UD2 and the system is not reading data from the disk, check IC UD2. If data pulses are missing at pin 22 of IC UD2, check Connector J8 and the Disk Drive interface cable.

If the Monitor displays an I/O ERROR when attempting to write data on a diskette that is not write protected, check for a logic Low at pin 21 of IC UD2 while running the following program.

```
10 X = PEEK (− 16151): X = PEEK (− 16150)
```

If pin 21 of IC UD2 is Low, check IC UD2. If pin 21 of IC UD2 is High, check the Disk Drive write-protect circuit.

VIDEO DISPLAY

No video on the Monitor screen, check the Video Output Jack (J4) and the cable connecting the Computer to the Monitor for good connections. If the cable and connectors check good, check the waveforms at pins 1 thru 4 of the VID IC (UE1). If the waveforms check good check IC UE1, Capcitor C65 and Coils L2 and L3. If the waveform is missing at pin 1 of IC UE1, check the waveforms on pins 2 thru 7, 10, 11, 12, 14 and 15 of the SPI IC (UE6). If the waveforms are correct at IC UE6, check IC UE6. If the waveform is missing at pins 6 or 15 of IC UE6, check the TMG IC (UD4). If the waveforms are missing at pins 2 thru 5, 10 thru 12 and 14 of IC UE6, check the Char Gen IC (UE4), Input/Output Unit IC (UE14), Video Latch IC (UE9), 80 DIR IC (UE11) and 80 Latch IC (UE8).

Low or high resolution graphics functions do not work check the Input/Output Unit IC (UE14). If the double high resolution graphics do not work, check the GLU IC (UD6).

TROUBLESHOOTING (Continued)

VIDEO SYNC

No horizontal or vertical sync. Check the sync waveforms at pin 2 of the VID IC (UE1). If the waveforms are present, check IC UE1. If the waveforms are missing, check the Input/Output Unit IC (UE14).

COLOR

No color. Check the waveform at pin 3 of the TMG IC (UD4). If the waveform is missing check IC UD4. If the waveform is good at pin 3 of IC UD4, type GR (computer in Basic mode) and press the Return key. Check the waveform at pin 37 of the Input/Output Unit IC (UE14). If the waveform is missing, check IC UE14. If the waveform is good at pin 37 of IC UE14 check the VID IC (UE1).

Hue is not correct. Check the adjustment of the Hue Adjust Coil (L2) (see Miscellaneous Adjustments) and check the frequency of the 14.31813MHz Oscillator Module at pin 1 of the GLU IC (UD6).

INTERNAL SPEAKER

No sound. Check the Speaker (SP1) and check connector J10 and Earphone jack (J7) for good connections. If the Speaker and connections check good, type in and run the following Basic program.

```
10 PRINT CHRS(7): GOTO 10
```

While the program is running, check for pulses at pin 8 of the Input/Output Unit IC (UE14). If pulses are missing, check IC UE14. If pulses are present at pin 8 of IC UE14, check the Volume Control (R3), Electrolytics C43 and C44, Coils L4 and L6 and the Audio IC (UA14).

SERIAL PORT 1 (PRINTER PORT)

Serial Port 1 not working. Check the 1.789MHz baud clock waveform at pin 12 of the Divider IC (UC7). If the waveform is missing check IC UC7. If the waveform is present at pin 12 of IC UC7, type in and run the following Basic program.

```
10 POKE – 16229,22
20 POKE – 16230,0
30 POKE – 16230,255
40 PRINT "DATA = "; PEEK (– 16232)
50 PRINT "STATUS = "; PEEK (– 16231)
60 FOR T = 1 TO 300: NEXT T
70 PRINT: GOTO 10
```

Serial Port 1 does not transmit data. While the program is running, check for pulses at pin 3 of the Serial 1 IC (UD11). If pulses are missing at pin 3 of IC UD11, check IC UD6. If pulses are present at pin 3 of IC UD11, check for pulses at pins 8, 10 and 11 of IC UD11. If pulses are missing at pin 8, 10 or 11 of IC UD11, check IC UD11. If pulses are present at pins 8, 10 and 11 of IC UD11, check for pulses at pins 3 and 6 of the Serial Output Buffer IC (UC11). Note: These pulses should have a voltage swing of – 10V to + 10V (20V peak to peak). If pulses are missing at pin 3 of IC UC11, check Capacitor C54 and IC UC11. If pulses are missing at pin 6 of IC UC11, check Capacitor C53 and IC UC11.

Serial Port 1 does not receive data. The Status number that appears on the Monitor screen should be 80. If the Status number is not 80, press the Control and Reset keys to stop the program and reset IC UD11. Run the program again and note the Status number. If the number is not 80 and pins 12 and 17 of IC UD11 read a logic High and pin 16 of IC UD11 reads logic Low, check IC UD11. If the Status number reads 80, connect a jumper from pin 4 of the Serial Input Buffer IC (UC4) to ground. The Status number should change from 80 to 112. If the Status number is not correct check for a logic High at pin 6 of IC UC4. If the logic reading is not correct, check IC UC4. If the logic reading is correct check IC UD11. If the Status number reads 112 with pin 4 of IC UC4 grounded, remove the jumper from pin 4 of IC UC4 and connect the jumper from pin 17 of IC UD11 to ground. The Status number on the Monitor screen should read 16. If the Status number is not correct check IC UD11. If the Status numbers are correct for pin 4 of IC UC4 and pin 17 of IC UD11, remove the jumper from pin 17 of IC UD11 and inject a 300Hz square wave from a TTL output of a function generator at pin 1 of IC UC4. Vary the frequency of the function generator back and forth between 100Hz and 300Hz. The Data number and Status number on the Monitor screen should change to random values. If neither number changes, check for pulses at pin 3 of IC UC4, while injecting the 300Hz signal at pin 1 of IC UC4. If pulses are missing at pin 3 of IC UC4 check IC UC4. If pulses are present at pin 3 of IC UC4 check IC UD11.

SERIAL PORT 2 (MODEM)

Serial Port 2 not working. Check the 1.789MHz baud clock waveform at pin 12 of the Divider IC (UC7). If the waveform is missing check IC UC7. If the waveform is present at pin 12 of IC UC7, type in and run the following Basic program.

```
10 POKE – 16213,22
20 POKE – 16214,0
30 POKE – 16214,255
40 PRINT "DATA = "; PEEK (– 16216)
50 PRINT "STATUS = "; PEEK (– 16215)
60 FOR T = 1 TO 300: NEXT T
70 PRINT: GOTO 10
```

Serial Port 2 does not transmit data. While the program is running, check for pulses at pin 3 of the Serial 2 IC (UD9). If pulses are missing at pin 3 of IC UD9, check IC UD6. If pulses are present at pin 3 of IC UD9, check for pulses at pins 8, 10 and 11 of IC UD9. If pulses are missing at pin 8, 10 or 11 of IC UD9, check IC UD9. If pulses are present at pins 8, 10 and 11 of IC UD9, check for pulses at pins 8 and 11 of the Serial Output Buffer IC (UC11). Note: These pulses should have a voltage swing of – 10V to + 10V (20V peak to peak). If pulses are missing at pin 8 of IC UC11, check Capacitor C56 and IC UC11. If pulses are absent at pin 11 of IC UC11, check Capacitor C55 and IC UC11.

Serial Port 2 does not receive data. The Status number that appears on the Monitor screen should be 16. If the status number is not 16, press the Control and Reset keys to stop the program and reset IC UD9. Run the program again and note the Status number. If the number is not 16 and pins 16 and 17 of IC UD9 read a logic Low and pin 12 of IC UD9 reads logic High, check IC UD9. If the Status number reads 16, connect a jumper from pin 13 of the Serial Input Buffer IC (UC4) to ground. The Status number should change from 16 to 48. If the Status number is not correct check for a logic High at pin 11 of IC UC4. If the logic reading is not correct, check IC UC4. If the logic reading is correct check IC UD9. If the Status number is correct for pin 13 of IC UC4, remove the jumper from pin 13 of IC UC4 and inject a 300Hz square wave from a TTL output of a function generator at pin 10 of

---

LOGIC (Continued)

PIN NO.	IC UE16	PIN NO.	IC UE16
1	L	21	P
2	P	22	P
3	P	23	P
4	P	24	P
5	P	25	H
6	P	26	H
7	P	27	H
8	P	28	L
9	P	29	L
10	P	30	L
11	P	31	H
12	P	32	H
13	P	33	L
14	H	34	L
15	H	35	H
16	H	36	L
17	H	37	P
18	H	38	P
19	H	39	P
20	P	40	P

PIN NO.	IC UE18	PIN NO.	IC UE18
1	L	21	L
2	H	22	L
3	P	23	L
4	H	24	H
5	H	25	H
6	H	26	P
7	P	27	P
8	H	28	P
9	P	29	P
10	P	30	P
11	P	31	P
12	P	32	P
13	P	33	P
14	L	34	H
15	H	35	*
16	L	36	*
17	L	37	P
18	H	38	H
19	H	39	P
20	L	40	H

PIN NO.	IC UF1	IC UF2	IC UF3	IC UF4	IC UF5	IC UF6
1	H	*	H	H	H	H
2	H	*	L	P	P	P
3	H	H	L	H	H	H
4	H	H	H	P	P	P
5	*	H	P	P	P	P
6	H	H	*	P	P	P
7	H	L	H	P	P	P
8	*	H	L	H	H	H
9	L	H	P	P	P	P
10	H	H	P	P	P	P
11	H	H	P	P	P	P
12	H	*	*	P	P	P
13	L	*	*	P	P	P
14	H	H	H	P	P	P
15	L		H	P	P	P
16	H		H	L	L	L

PIN NO.	IC UF7	IC UF8	IC UF9	IC UF10	IC UF11	IC UF12	IC UF13	IC UF14	IC UF15	IC UF16	IC UF17	IC UF18	IC UF19
1	H	H	H	H	H	H	H	H	H	H	H	H	H
2	P	P	P	P	P	P	P	P	P	P	P	P	P
3	H	H	H	H	H	H	H	H	H	H	H	H	H
4	P	P	P	P	P	P	P	P	P	P	P	P	P
5	P	P	P	P	P	P	P	P	P	P	P	P	P
6	P	P	P	P	P	P	P	P	P	P	P	P	P
7	P	P	P	P	P	P	P	P	P	P	P	P	P
8	H	H	H	H	H	H	H	H	H	H	H	H	H
9	P	P	P	P	P	P	P	P	P	P	P	P	P
10	P	P	P	P	P	P	P	P	P	P	P	P	P
11	P	P	P	P	P	P	P	P	P	P	P	P	P
12	P	P	P	P	P	P	P	P	P	P	P	P	P
13	P	P	P	P	P	P	P	P	P	P	P	P	P
14	P	P	P	P	P	P	P	P	P	P	P	P	P
15	P	P	P	P	P	P	P	P	P	P	P	P	P
16	L	L	L	L	L	L	L	L	L	L	L	L	L

Voltages, logic readings and waveforms taken in Power Up mode, Caps Lock and 80/40 Column keys down, Keyboard Switch up, no diskette in the Disk Drive "Apple IIc" and "Check Disk Drive" displayed on the Monitor screen.

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No light On)

(1) Probe indicates H if diskette is write protected or Head Position is operating.
(2) Probe indicates P when Head Position motor is operating.
(3) Readings taken after pressing Space Bar on keyboard.
(4) Probe indicates H when any key pressed except Control, Shift, Open Apple, Closed Apple and Reset keys.
(5) Probe indicates H when Caps Lock key is up.
(6) Probe indicates P when any key pressed except Control, Shift, Open Apple, Closed Apple and Reset keys.
(7) Probe indicates P when Computer is in "Basic" mode.
(8) Probe indicates L when the Control key is pressed.

LOGIC (Continued)

PIN NO.	IC UD9	PIN NO.	IC UD9
1	L	17	L
2	L	18	P
3	H	19	P
4	H	20	P
5	*	21	P
6	P	22	P
7	P	23	P
8	H	24	P
9	L	25	P
10	H	26	H
11	H	27	P
12	H	28	H
13	P		
14	P		
15	H		
16	L		

PIN NO.	IC UD11	PIN NO.	IC UD11
1	L	17	H
2	P	18	P
3	H	19	P
4	H	20	P
5	*	21	P
6	P	22	P
7	P	23	P
8	H	24	P
9	L	25	P
10	H	26	H
11	H	27	P
12	H	28	H
13	P		
14	P		
15	H		
16	L		

PIN NO.	IC UD16	PIN NO.	IC UD16
1	L(3)	13	P
2	L(3)	14	P
3	L(3)	15	P
4	H(3)	16	P
5	L(3)	17	*
6	L(3)	18	L
7	H(3)	19	L
8	H(3)	20	H((7)
9	P	21	H
10	P	22	L(5)
11	P	23	H(3)
12	L	24	H

PIN NO.	IC UD18	PIN NO.	IC UD18
1	H	17	P
2	L	18	P
3	L	19	P
4	H	20	P
5	L	21	P
6	P	22	L
7	P	23	L
8	P	24	H
9	P	25	L
10	P	26	L
11	P	27	H
12	P	28	H
13	P		
14	L		
15	P		
16	P		

PIN NO.	IC UE1	IC UE4	IC UE6	IC UE8	IC UE9	IC UE11
1	P	P	P	P	P	H
2	P	P	P	P	P	P
3	P	P	P	P	P	P
4	H	P	P	P	P	P
5	L	P	P	P	P	P
6	L	P	P	P	P	P
7	L	P	P	P	P	P
8	L	P	L	P	P	P
9	L	P	H	P	P	P
10	H	P	P	L	L	L
11		P	P	P	P	P
12		L	P	P	P	P
13		P	P	P	P	P
14		P	P	P	P	P
15		P	P	P	P	P
16		P	H	P	P	P
17		P		P	P	P
18		P		P	P	P
19		P		P	P	H
20		L		H	H	H
21		L				
22		P				
23		P				
24		H				

PIN NO.	IC UE14	PIN NO.	IC UE14
1	L	21	P
2	L	22	P
3	P	23	P
4	P	24	P
5	P	25	P
6	H	26	P
7	L	27	P
8	L	28	H
9	P	29	H
10	*	30	H
11	L	31	L(4)
12	*	32	L
13	*	33	P
14	H	34	P
15	H	35	P
16	H	36	P
17	P	37	H
18	P	38	P
19	P	39	P
20	P	40	P

Voltages, logic readings and waveforms taken in Power Up mode, Caps Lock and 80/40 Column keys down, Keyboard Switch up, no diskette in the Disk Drive "Apple IIc" and "Check Disk Drive" displayed on the Monitor screen.

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No light On)

(1) Probe indicates H if diskette is write protected or Head Position is operating.
(2) Probe indicates P when Head Position motor is operating.
(3) Readings taken after pressing Space Bar on keyboard.
(4) Probe indicates H when any key pressed except Control, Shift, Open Apple, Closed Apple and Reset keys.
(5) Probe indicates H when Caps Lock key is up.
(6) Probe indicates P when any key pressed except Control, Shift, Open Apple, Closed Apple and Reset keys.
(7) Probe indicates P when Computer is in "Basic" mode.
(8) Probe indicates L when the Control key is pressed.

TROUBLESHOOTING (Continued)

IC UC4. Vary the frequency of the function generator back and forth between 100Hz and 300Hz. The Data number and Status number on the Monitor screen should change to random values. If neither number changes, check for pulses at pin 8 of IC UC4, while injecting the 300Hz signal at pin 10 of IC UC4. If pulses are missing at pin 8 of IC UC4, check IC UC4. If pulses are present at pin 8 of IC UC4 check IC UD9.

GAME PADDLES DO NOT FUNCTION

Type in and run the following Basic program to check the operation of the game paddle circuits.

```
10 HOME
20 PRINT "PADDLE 0", PDL (0)
30 PRINT "PADDLE 1", PDL (1)
40 FOR T = 1 TO 300: NEXT T
50 GOTO 10
```

The program scans the two paddles and displays the paddle numbers (0 and 1) on the Monitor screen along with a number that is read from each paddle. The number read from each paddle should vary between 0 and 255 as that paddle is varied from MINIMUM to maximum. If paddles are not available, a 100K potentiometer can be used by connecting one end of the potentiometer to 5.0V (pin 2 of connector J3) and the center tap to one of the paddle inputs (pin 5 or 8 of connector J3).

If the paddle inputs are not functioning, check connector J3 for good connections. Check for pulses at pin 6 of the Paddle IC (UF2) and pin 7 of the Multiplexer IC (UF3) while the above program is running. If pulses are missing at either pin 6 of IC UF2 or pin 7 of IC UF3, check the Memory Management Unit IC (UE16). If pulses are present at pin 6 of IC UF2 and pin 7 of IC UF3 and Paddle 0 is not working, check for pulses at pin 5 of IC UF2 while the program is running. If pulses are missing at pin 5 of IC UF2, check Capacitor C47, Resistor R7 and IC UF2. If pulses are present at pin 5 of IC UF2, check IC UF3. If Paddle 1 is not working, check for pulses at pin 9 of IC UF2 while the program is running. If pulses are missing at pin 9 of IC UF2, check Capacitor C48, R8, and IC UF2. If pulses are present at pin 9 of IC UF2, check IC UF3.

JOYSTICKS DO NOT FUNCTION

Type in and run the following Basic program to check the operation of the joystick circuits.

```
10 HOME
20 PRINT "X POSITION", PDL (0)
30 PRINT "Y POSITION", PDL (1)
40 PRINT "SWITCH 0 = ", PEEK ( – 16287)
50 PRINT "SWITCH 1 = ", PEEK ( – 16286)
60 FOR T = 1 TO 300: NEXT T
70 GOTO 10
```

This program scans the joystick circuit and displays "X POSITION" and "Y POSITION", each followed by a number from 0 to 255. Also displayed on the Monitor is "SWITCH 0" and "SWITCH 1", each followed by a number. When the joystick is moved to the extreme right, the "X POSITION" will read 255 and it will read 0 when the joystick is moved to the extreme left. When the Joystick is moved to the extreme lower position, the "Y POSITION" will read 255 and it will read 0 when the joystick is at the top. The number displayed after "SWITCH 0" and "SWITCH 1" will be 127 or less until the pushbutton is pressed. When the left pushbutton is pressed "SWITCH 0" will read 128 or more and "SWITCH 1" will read 128 or more when the top pushbutton is pressed.

If the joystick inputs are not functioning, check Connector J3 for good connections. Check for pulses at pin 6 of the Paddle IC (UF2) and at pin 7 of the Multiplexer IC (UF3) while the above program is running. If pulses are missing at either pin 6 of IC UF2 or pin 7 of IC UF3, check the Memory Management Unit IC (UE16). If the pulses are present at pin 6 of IC UF2 and pin 7 of IC UF3 and the X POSITION does not function, check for pulses at pin 5 of IC UF2 while the program is running. If the pulses are missing at pin 5 of IC UF2, check Capacitor C47, Resistor R7 and IC UF2. If the pulses are present at pin 5 of IC UF2, check IC UF3. If the Y POSITION does not function, check for pulses at pin 9 of IC UF2 while the program is running. If the pulses are missing at pin 9 of IC UF2, check Capcitor C48, Resistor R8 and IC UF2. If the pulses are present at pin 9 of IC UF2, check IC UF3. Also check the Input/Output Unit IC (UE14).

If the joystick pushbuttons do not function, check Connector J3 for good connections. Also check the joystick cable. Press the left pushbutton (Switch 0) and check for a logic High at pin 2 of IC UF1. If pin 2 of UF1 is logic High when the pushbutton is pressed, check for a logic High at pin 13 of UF1 when the pushbutton is pressed. If pin 13 of UF1 is not logic High, check IC UF1. If pin 13 of UF1 is logic High, check the Multiplexer IC (UF3).

Press the top pushbutton (Switch 1) and check for a logic High at pin 6 of IC UF1. If pin 6 of IC UF1 is logic High when the pushbutton is presed, check for a logic High at pin 9 of IC UF1. If pin 9 of UF1 is not logic High, check IC UF1. If pin 9 of UF1 is logic High, check the Multiplexer IC (UF3).

MOUSE

The following program can be used to check the operation of the Mouse. Note: This program will not work with PRODOS. It will work with DOS 3.3 or without any DOS loaded into the Computer (press the Control and Reset keys to put the Computer in Basic mode).

```
10 PR# 4: PRINT CHRS(1)
20 IN#4
30 INPUT " "; X, Y, B
40 IN# 0: PR#0
50 HOME
60 PRINT "X", "Y", "BUTTON"
70 PRINT X, Y, B
80 FOR T = 1 to 300: NEXT T
90 GOTO 30
```

The program will display the X and Y coordinates (0 to 1023) along with the button Status (4 = button released, 3 = button just released, 2 = button just pressed, and 1 = button held down) on the Monitor screen. The button Status number will be negative if a key on the keyboard is pressed.

If the Mouse is not working, check Connector J3 for good connections. If Connector J3 checks good, check for pulses at pins 4, 5, 8 and 9 of Connector J3 while moving the Mouse in a circle on a flat surface. Note: The above program does not have to be running. If pulses are missing at Connector J3, check the Mouse. If pulses are present at Connector J3, check for pulses at pin 7 of the Multiplexer IC

TROUBLESHOOTING (Continued)

(UF3) while the above program is running. If pulses are missing at pin 7 of IC UF3, check the Memory Management Unit IC (UE16). If pulses are present at pin 7 of IC UF3, check IC UF3 and the Input/Output Unit IC (UE14).

Mouse button does not work. Check for a logic Low at pin 7 of Connector J3 while pressing the Mouse button. If the reading is not correct check Connector J3 for good connections and check the switch inside the Mouse and the Mouse cable. If the logic reading is Low at pin 7 of Connector J3, check for a logic Low at pin 16 of the SJK IC (UF1) while pressing the Mouse button. If the reading is not correct at pin 16 of IC UF1 check IC UF1. If the reading is Low at pin 16 of IC UF1, check IC UF3.

LOW POWER INDICATOR

The green Power LED (CR2) will start flashing when the voltage at pin 5 of the Power Connector (J1) drops below 10.0V. To check the low power indicator circuits, connect a variable DC power supply (rated at 2 amps output) to Connector J1 (positive to pin 5 and negative to pin 2 of Connector J1). With the power supply output set to 12V, turn the Computer On. Reduce the power supply output to 9.5V. If the Power LED (CR2) is not flashing, check for 4.9V at pin 7 of the Low Power Detector IC (UB18) with the Power Supply set to 9.5V. If the reading is not correct check Resistors R11, R21, R13 and R22 and IC UB18. If the reading is correct at pin 7 of IC UB18, check Electrolytic C51, Resistors R12, R14 and R15 and Low Power Flasher IC (UC18).

MISCELLANEOUS ADJUSTMENTS

HUE ADJUST

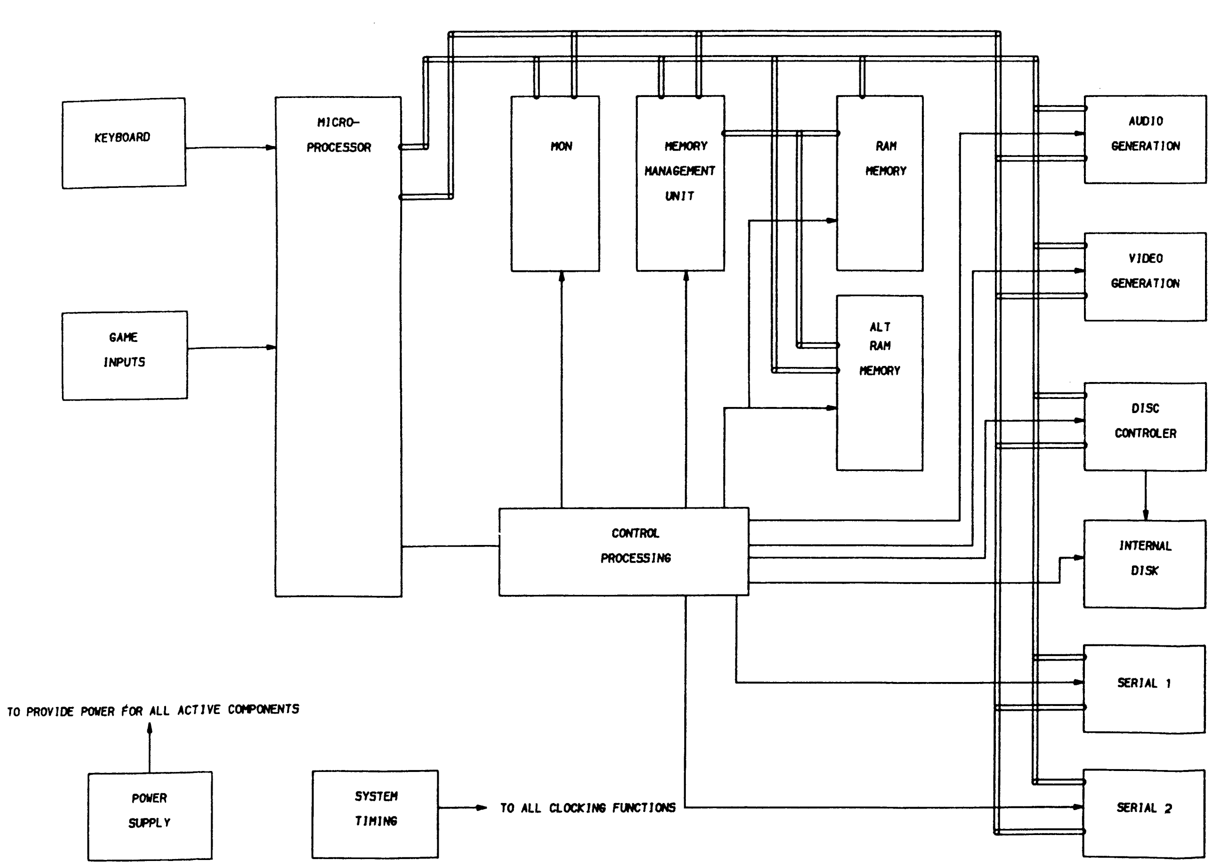
Type in and run the following Basic program.

```
10 GR
20 FOR X = 20 TO 22
30 READ Y: COLOR = Y
40 HLIN 0,39 AT X: NEXT X
50 DATA 2,9,12
```

The program produces blue, orange and green lines on a color Monitor screen. Adjust Hue Adjust Coil (L2) for proper blue, orange and green hues.

ALIGNMENT TOOLS

	GC ELECTRONICS
L2	9300, 9302, 9304



BLOCK DIAGRAM

LOGIC

PIN NO.	IC UA14
1	L
2	*
3	H
4	H
5	H
6	H
7	L

PIN NO.	IC UB16	PIN NO.	IC UB16
1	P	21	L
2	P	22	L
3	P	23	L
4	L	24	L
5	L(4)	25	L
6	L(3)	26	L
7	L(3)	27	L
8	H(3)	28	H(8)
9	L(3)	29	H
10	L(3)	30	H
11	L(3)	31	L(6)
12	H(3)	32	P
13	H(3)	33	P
14	H(3)	34	P
15	L	35	P
16	L(6)	36	P
17	L	37	P
18	L	38	P
19	L	39	P
20	L	40	P

PIN NO.	IC UB18	IC UC4	IC UC7	IC UC9	IC UC11	IC UC18	IC UD2	IC UD4	IC UD6
1	L	L	H	H	L	L	H	P	P
2	H	L	P	H	H	L	L	P	P
3	H	H	*	H	L	L	P	P	P
4	L	H	*	P	H	L	P	P	P
5	H	P	*	H	H	H	P	P	L
6	H	L	*	H	L	L	P	P	H
7	L	L	H	L	L	L	H	H	L
8	H	H	L	H	L	H	H	H	P
9		L	H	H	H		H	H	H
10		L	H	L	H		P	L	L
11		L	P	H	L		P	L	H
12		P	P	*	H		P	P	L
13		H	P	*	H		P	P	L
14		H	P	H	H		L	P	P
15			P				P	P	H
16			H				P	P	H
17							P	P	H
18							P	P	H
19							H	P	H
20							H	H	H
21							H		H
22							H		H
23							H		H
24							P		H
25							P		
26							H		
27							L		
28							L		

Voltages, logic readings and waveforms taken in Power Up mode, Caps Lock and 80/40 Column keys down, Keyboard Switch up, no diskette in the Disk Drive "Apple IIc" and "Check Disk Drive" displayed on the Monitor screen.

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No light On)

(1) Probe indicates H if diskette is write protected or Head Position is operating.

(2) Probe indicates P when Head Position motor is operating.

(3) Readings taken after pressing Space Bar on keyboard.

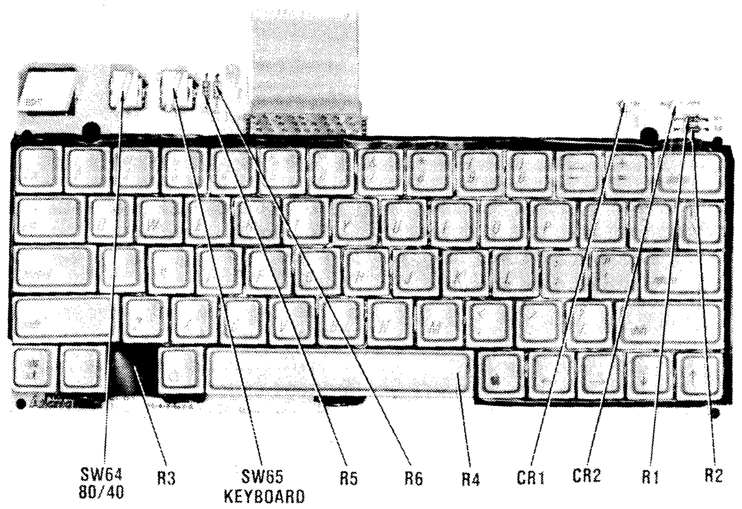
(4) Probe indicates H when any key pressed except Control, Shift, Open Apple, Closed Apple and Reset keys.

(5) Probe indicates H when Caps Lock key is up.

(6) Probe indicates P when any key pressed except Control, Shift, Open Apple, Closed Apple and Reset keys.

(7) Probe indicates P when Computer is in "Basic" mode.

(8) Probe indicates L when the Control key is pressed.



KEYBOARD

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

COILS & TRANSFORMERS

ITEM No.	FUNCTION	MFGR. PART No.	OTHER IDENTIFICATION	NOTES
	SWITCHING POWER SUPPLY BOARD			
T1	Switching		85210202650 (1)	
T2	Feedback			
T3	Feedback		85210202670 (1)	

(1) Number on unit.

FUSE DEVICES

ITEM NO.	DESCRIPTION	MFGR. PART NO.		NOTES
		DEVICE	HOLDER	
	SYSTEM BOARD			
F1	10A @ 32V Fast Acting			

SPEAKER

ITEM No.	TYPE	REPLACEMENT DATA		NOTES
		MFGR. PART No.	QUAM PART No.	
SP1	1.5" PM 8 Ohms .1W	A0102-1 (1)		

(1) Number on unit.

CABINET & CABINET PARTS (When ordering specify model, chassis & color)

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
	SYSTEM BOARD		
OS1	Oscillator	CK0044AC	14.31818MHz
S1	Switch		Power, On-Off
Y1	Crystal		Future Optional Part
	P.C. Board		System Board
	Power Pack	A2M4017	Input (120VAC, 60Hz, 25W, .2A) Output (15VDC, 18W, 1.2A)
	KEYBOARD		
CR1	LED		Disk Use, Red.
CR2	LED		Power, Green.
SW1 thru SW62	Switch		Keyboard Keys
SW63	Switch		Reset Key
SW64	Switch		80/40 Column Select Key
SW65	Switch		Keyboard Select Key

PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA					
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
	SYSTEM BOARD							
CR1	1N5400		GE-512	NTE156	ECG156	SK3051/156	WEP4008/5809	212-Z9000
CR2,3	1N5712			NTE584	ECG584			
Q1	2N2369		GE-20	NTE123A	ECG123A	SK3444/123A	WEP736/123A	121-Z9000A
UA14	343-1002							
UB13	7905UC		GE-961	NTE961	ECG961	SK3671/961		HE-442-630
UB16	AY-5-3600-PRO							
UB18	LM311NDS			NTE922M	ECG922M	SK3668/922M		HE-442-75
UC4	UA1489PCQR			NTE75189	ECG75189	SK5189/75189		HE-443-795
	MC1489			NTE75189	ECG75189	SK5189/75189		HE-443-795
UC7	DM74LS161AN		74LS161A	NTE74LS161A	ECG74LS161A	SK74LS161		HE-443-757
UC9	74LS32N		74LS32	NTE74LS32	ECG74LS32	SK74LS32		HE-443-875
UC11	MC1488PD			NTE75188	ECG75188	SK5188/75188		HE-443-794
UC18	NE555P		GEIC-269	NTE955M	ECG955M	SK3564/955M	WEP2119/955M	221-Z9042
UD2	344-0041-A							
UD4	HAL16R8CN							
UD6	HAL20X4CNS							
UD9,11	338-6551-A							
UD16	342-0132-B							
	2716							
UD18	342-0272-A							
	27128A							
UE1	343-1001							
UE4	342-0265-A							
	2732							
	2764							
UE6	SN74LS166AN		74LS166	NTE74LS166	ECG74LS166			HE-443-892
UE8,9	74LS374N		74LS374	NTE74LS374	ECG74LS374			HE-443-863
UE11	74LS245N		74LS245	NTE74LS245	ECG74LS245	SK74LS245		HE-443-885
UE14	344-0021							

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA					
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
UE16	344-0011							
UE18	65C02A							
UF1	2401							
UF2	NE556N			NTE978	ECG978	SK3689/978		221-Z9152
UF3	SN74LS251NDS			NTE74LS251	ECG74LS251			
UF4 thru	MT4264							
UF19	6664				ECG6664			
	SWITCHING POWER SUPPLY BOARD							
D1	1N4606R		GE-300	NTE177	ECG177	SK9091/177	WEP1062/177	103-131
D2	G18341							
D3	1N4606R		GE-300	NTE177	ECG177	SK9091/177	WEP1062/177	103-131
D4,5	G18341							
D6	1N4606R		GE-300	NTE177	ECG177	SK9091/177	WEP1062/177	103-131
D7	S5S4M							
D8	G13403							
D9	G18403							
D10,11	1N4606R		GE-300	NTE177	ECG177	SK9091/177	WEP1062/177	103-131
IC1	TL431CLP							
Q1	2SA673A		GE-269	NTE290A	ECG290A	SK9132	WEP911/290A	121-Z9003*
Q2	X44C758							
Q3	BUV26							
Q4	2SA673A		GE-269	NTE290A	ECG290A	SK9132	WEP911/290A	121-Z9003*
Q5	2SB561C		GE-272	NTE298	ECG298	SK3450/298	WEP915/298	121-Z9103
Z1	5B7							

* Lead configuration may vary from original.

WIRING DATA

Shielded Hook-up Wire .... Use BELDEN No. 8401 or 8421 (Single-Conductor)
8208 (Two-Conductor)
9534 (Four-Conductor)
General-use Unshielded Hook-up Wire ...... Use BELDEN No. 8529 (Solid) Available In 13 Colors
8522 (Stranded) Available In 13 Colors
75-Ohm Input Lead .... Use BELDEN No. 8241

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

CAPACITORS

Items Not Listed Are Normally Available At Local Distributors.

ITEM No.	RATING	MFGR. PART No.
	SYSTEM BOARD	
C46	47 N470 50V 5%	

ITEM No.	RATING	MFGR. PART No.

CONTROLS (All wattages ½ watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
	SYSTEM BOARD			
R3	Volume Control	500		

RESISTORS (Power and Special)

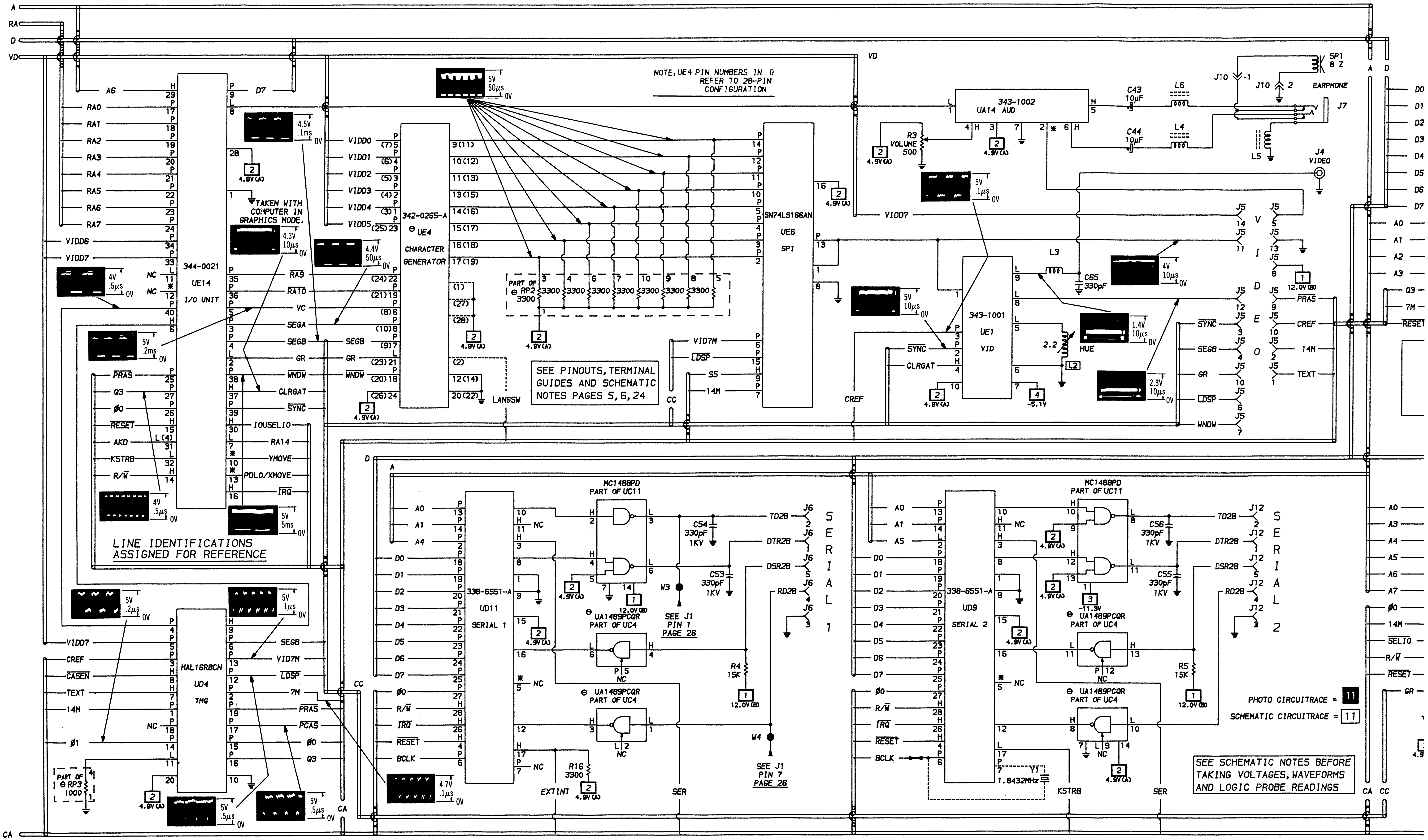
ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
	SYSTEM BOARD			
R11	11K 1% 1/4W Metal Film			
R13	10K 1% 1/4W Metal Film			
R21	10K 1% 1/4W Metal Film			
R22	100K 1% 1/4W Metal Film			
RP1	Resistor Network	(1)		
RP2	Resistor Network	(2)		
RP3	Resistor Network	(3)		
RP4	Resistor Network	112-0315 (4)		
	SWITCHING POWER SUPPLY BOARD			
R28	2700 2% 1/4W Metal Film		QW227	22-2246
R29	2700 2% 1/4W Metal Film		QW227	22-2246

(1) Contains nine 1000
(2) Contains nine 3300
(3) Contains seven 1000
(4) Number on unit

COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.
	SYSTEM BOARD	
L1	Line Choke	
L2	Hue Adjust	
L3	Peaking	
L4	RF Choke	
L5	RF Choke	
L6	RF Choke	

ITEM No.	FUNCTION	MFGR. PART No.
	SWITCHING POWER SUPPLY BOARD	
L1	RF Choke	
L2	RF Choke	
L3	RF Choke	
L4	RF Choke	
L5	RF Choke	


NOTE, UE4 PIN NUMBERS IN () REFER TO 28-PIN CONFIGURATION
344-0021 UE14 I/O UNIT
342-0265-A ⊖ UE4 CHARACTER GENERATOR
SN74LS166AN UE6 SPI
343-1002 UA14 AUD
343-1001 UE1 VID
HAL16R8CN UD4 TMG
338-6551-A UD11 SERIAL 1
338-6551-A UD9 SERIAL 2
MC1488PD PART OF UC11
⊖ UA1489PCQR PART OF UC4
PART OF ⊖ RP2 3300
PART OF ⊖ RP3 1000
TAKEN WITH COMPUTER IN GRAPHICS MODE.
SEE PINOUTS, TERMINAL GUIDES AND SCHEMATIC NOTES PAGES 5, 6, 24
LINE IDENTIFICATIONS ASSIGNED FOR REFERENCE
SEE J1 PIN 1 PAGE 26
SEE J1 PIN 7 PAGE 26
R3 VOLUME 500
SP1 8 Z
EARPHONE
J4 VIDEO
HUE
Y1 1.8432MHz
S E R I A L 1
S E R I A L 2
V I D E O
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
SEE SCHEMATIC NOTES BEFORE TAKING VOLTAGES, WAVEFORMS AND LOGIC PROBE READINGS

A PHOTOFACT STANDARD NOTATION SCHEMATIC WITH CIRCUITRACE

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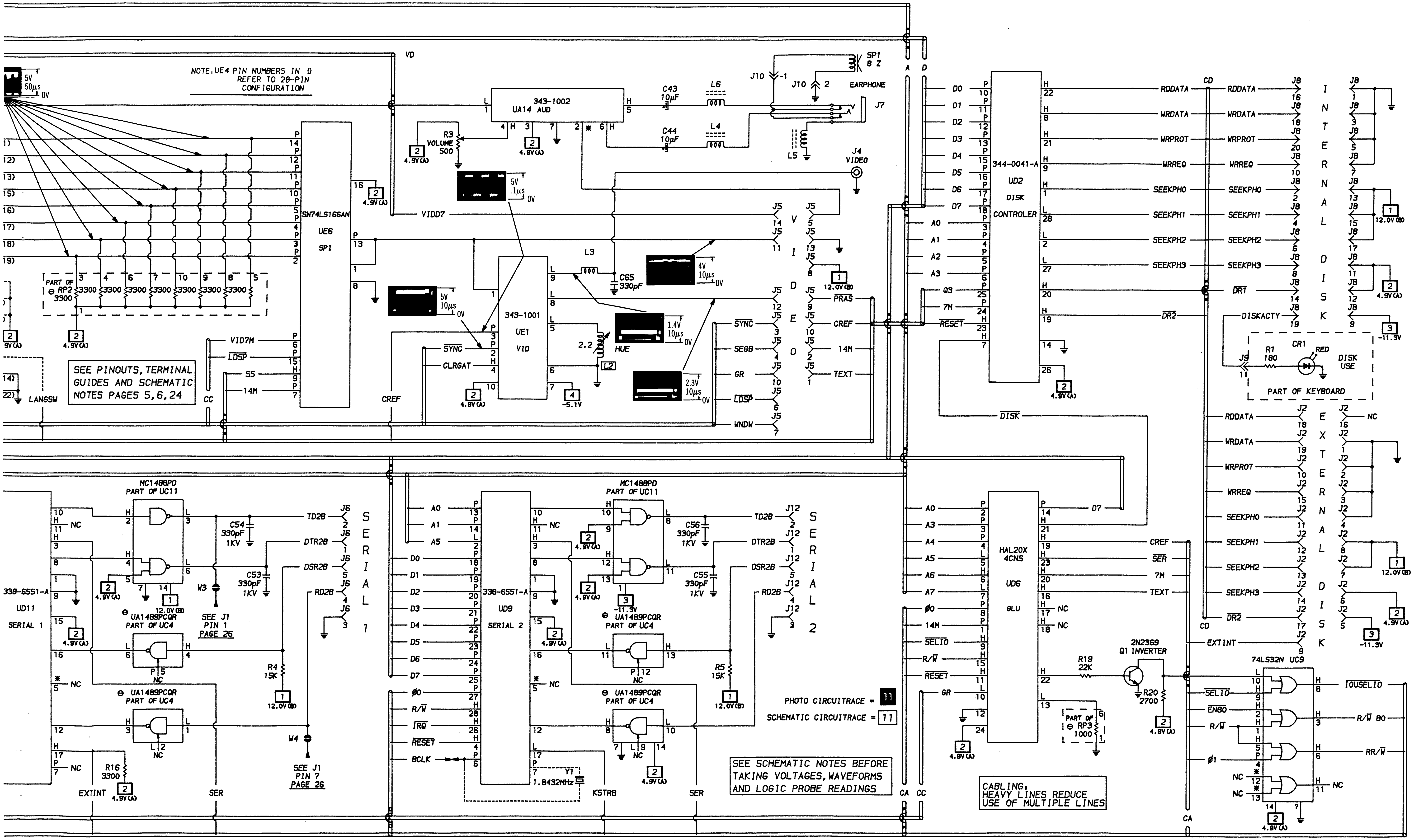
SYSTEM BOARD


NOTE: UE4 PIN NUMBERS IN () REFER TO 28-PIN CONFIGURATION
SN74LS166AN UE6 SPI
PART OF RP2 3300
SEE PINOUTS, TERMINAL GUIDES AND SCHEMATIC NOTES PAGES 5, 6, 24
LANGSW
VID7M
LDSP
S5
14M
CC
CREF
VD
VIDD7
343-1002 UA14 AUD
R3 VOLUME 500
C43 10μF
C44 10μF
L6
L4
L5
J10
SP1 8 Z
EARPHONE
J7
J4 VIDEO
343-1001 UE1 VID
SYNC
CLRGAT
L3
C65 330pF
HUE
L2
2.2
V I D E O
J5
PRAS
CREF
14M
TEXT
SYNC
SEGB
GR
LDSP
WNDW
344-0041-A UD2 DISK CONTROLER
D0 D1 D2 D3 D4 D5 D6 D7
A0 A1 A2 A3
Q3
7M
RESET
RDDATA
WRDATA
WRPROT
WRREQ
SEEKPH0
SEEKPH1
SEEKPH2
SEEKPH3
DR1
DR2
DISKACTY
DISK
J8
I N T E R N A L D I S K
CR1 RED
R1 180
DISK USE
PART OF KEYBOARD
J2
E X T E R N A L D I S K
EXTINT
MC1488PD PART OF UC11
UA1489PCQR PART OF UC4
338-6551-A UD11 SERIAL 1
C54 330pF 1KV
C53 330pF 1KV
W3
W4
SEE J1 PIN 1 PAGE 26
SEE J1 PIN 7 PAGE 26
R4 15K
R16 3300
TD2B
DTR2B
DSR2B
RD2B
J6
S E R I A L 1
SER
338-6551-A UD9 SERIAL 2
A0 A1 A5
ϕ0
R/W
IRQ
RESET
BCLK
Y1 1.8432MHz
KSTRB
C56 330pF 1KV
C55 330pF 1KV
R5 15K
J12
S E R I A L 2
PHOTO CIRCUITRACE = 11
SCHEMATIC CIRCUITRACE = 11
SEE SCHEMATIC NOTES BEFORE TAKING VOLTAGES, WAVEFORMS AND LOGIC PROBE READINGS
HAL20X 4CNS UD6 GLU
A3 A4 A5 A6 A7
SELIO
SER
7M
TEXT
R19 22K
2N2369 Q1 INVERTER
R20 2700
PART OF RP3 1000
74LS32N UC9
IOUSELIO
EN80
R/W 80
RR/W
ϕ1
NC
CABLING: HEAVY LINES REDUCE USE OF MULTIPLE LINES
CA CC
CD
A D
4.9V(A)
12.0V(B)
-11.3V
-5.1V

SYSTEM BOARD

APPLE MODEL IIc

PRELIMINARY SERVICE CHECKS (Continued)
GENERAL OPERATING INSTRUCTIONS

POWER UP

The Computer will boot up automatically on any bootable diskette that is in the Disk Drive when turned On. If no diskette is in the Disk Drive when the Computer is turned On, the Computer will come up with "Apple IIc" and "Check Disk Drive" on the Monitor screen. Press the Control and Reset keys at the same time to put the Computer in Basic mode.

SWITCHING FROM BASIC TO MONITOR MODE

Type CALL-151 and press RETURN key. An asterisk will appear on the Monitor screen indicating the Computer is in the Monitor mode.

SWITCHING FROM MONITOR TO BASIC MODE

Press the CONTROL and C keys at the same time, then press the RETURN key (any Basic program already in memory, before going to the Monitor mode, will remain in memory).

Press the CONTROL and B keys at the same time, then press the RETURN key (any Basic program in memory will be lost).

RESET

Press the CONTROL and RESET keys at the same time to reset the Computer to Basic mode. Press the OPEN APPLE key (located on the left side of SPACE bar), CONTROL key and RESET key at the same time to reboot the system on any bootable diskette in the Disk Drive.

OPERATING THE DISK SYSTEM FROM BASIC MODE (DOS3.3)

Type CATALOG and press the RETURN Key to get a list of the programs which are on the diskette. Type CATALOG, D1 for Disk Drive 1 or CATALOG, D2 for Disk Drive 2 if the current Disk Drive is not the one desired.

Type LOAD and the program name, then press the RETURN key to load a program from the diskette.

Type SAVE and the program name, then press the RETURN key to save a program on the diskette.

BOOTING UP THE DISK OPERATING SYSTEM (DOS)

Insert a diskette containing a DOS into the Disk Drive and turn On the Computer. The Computer will automatically load the DOS and come up in Basic mode if DOS3.3 is used. If PRODOS is used the Computer will come up with menu of PRODOS features on the Monitor screen.

To boot from Basic mode, type PR#6 or 1N#6 and press the RETURN key. If there is no diskette in the Disk Drive, the Disk Drive will stop and the message "Check Disk Drive" will appear on the Monitor screen.

DOS can also be rebooted by pressing the OPEN APPLE key (located on left side of SPACE bar), CONTROL key and RESET key at the same time.

USING BLANK DISKETTES

A blank diskette must be initialized (DOS3.3) or Formatted (PRODOS) before it can be used to save data. To initialize a diskette using DOS3.3, boot the disk operating system from a diskette containing DOS3.3, remove the DOS3.3 diskette and put the blank diskette into the Disk Drive. Type INIT HELLO and press the RETURN key. The diskette will be initialized when the drive stops. NOTE: Any previous information on diskette will be over written and lost when initialized.

If PRODOS is being used, select the PRODOS FILER (press F key) from the menu that comes up when PRODOS is booted up. Select Volume Commands (press V key) from the second menu that comes up and then select Format A Volume (press F key) from the third menu that comes up. Insert the blank diskette into the Disk Drive and follow the instructions on the Monitor screen to format the diskette.

80/40 COLUMN SWITCH

This switch takes effect only if the program being used checks to see if the switch is down (40 column) or up (80 column). The program then automatically sets the 40 or 80 column mode according to the switch setting.

To select 80 column mode manually press the ESC key then press the 8 key or type PR#3 and press the Return key.

To select 40 column mode manually press the ESC key then press the Control and Q keys at the same time or type PR#0 and press the Return key.

DISASSEMBLY INSTRUCTIONS

CABINET REMOVAL

Turn the Computer upside down. Remove four screws from under the keyboard and two screws located in front of the handle. Turn the Computer right side up and extend the handle. Release the front latch tab. Lift the top front up and back to clear the rear panel.

DISK DRIVE REMOVAL

Remove four screws from cabinet bottom. Disconnect Disk Drive from System board and remove Disk Drive.

POWER SUPPLY REMOVAL

Remove two screws securing Switching Power Supply. Slide Switching Power Supply back and remove from Connector. To remove Switching Power Supply board from shield, remove the two screws near the edge connector and loosen the screw on the side of the shield. Slide the shield backward to free lock tabs and carefully separate from board.

SYSTEM BOARD REMOVAL

Disconnect the speaker. Remove nine screws holding System board and remove.

SAMS COMPUTERFACTS™

APPLE
MODEL IIc

CSCS7
APPLE
MODEL IIc

PRELIMINARY SERVICE CHECKS

This data provides the user with a time-saving service tool which is designed for quick isolation and repair of Computer malfunctions.

Check all interconnecting cables for good connection and correct hookup before making service checks.

Disconnect all peripherals except the Monitor from the Computer to eliminate possible external malfunctions.

Replacement or repair of the Power Pack, Switching Power Supply Module, System Board, Keyboard, or Connectors may be necessary after the malfunction has been isolated.

TEST EQUIPMENT AND TOOLS

TEST EQUIPMENT

Digital Volt/Ohm Meter
Logic Probe

TOOLS

Low Wattage Soldering Iron
Desoldering Equipment
Head Cleaning Equipment
Switch Cleaner (non spray type)
Phillips Screwdriver
Flat Blade Screwdriver
IC Insertion and Removal Tools 24, 28 and 40 pin

CSCS7
APPLE
MODEL IIc

REPLACEMENT PARTS AND DESCRIPTION

ITEM	PART NO.	DESCRIPTION
DISK DRIVE		
M1		Drive Motor
MONITOR		
D701 thru D704		Rectifier Diode, G2GD1
F701		Fuse, 1.5A @250V
F771		Fuse, 750mA @250V
Q18		Horizontal Output Transistor, BU406
Q701		DC Voltage Regulator Transistor, BD534L

ITEM	PART NO.	DESCRIPTION
POWER SUPPLY		
	A2M4017	Power Pack
	AA7341B	Switching Power Supply
SYSTEM BOARD		
C57		Electrolytic, 1000μF 25V
C59		Capacitor, .1μF 50V
CR1		Diode, 1N5400
F1		Fuse, 10A GFA Subminiature Pigtail
SP1		Speaker
SW1		Power Switch
UD18	342-0272-A	IC, ROM, 27128A
UE4	342-0265-A	IC, Character Generator
UE14	344-0021	IC, Input/Output Unit
UE16	344-0011	IC, Memory Management Unit
UE18		IC, CPU, 65C02

SAMS™ **Howard W. Sams & Co., Inc.**
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PRELIMINARY SERVICE CHECKS (Continued)

SERVICE CHECKS

SEE INTERCONNECTING DIAGRAM AND PHOTOS TO MATCH THE NUMBER IN THE CIRCLES WITH THOSE IN THE FOLLOWING DATA FOR SERVICE CHECKS TO BE PERFORMED.

① COMPUTER DEAD

(A) Unplug the Power Pack from the Computer and check for 18.2V between pins 2 and 6 of Power Pack Plug P1. If the 18.2V is missing, replace the Power Pack.

(B) If 18.2V is present at Plug P1, plug the Power Pack back into the Computer. With the Computer turned Off, check for 17.5V at the junction of Fuse F1 and Capacitor C59. If the voltage is missing at the junction of F1 and C59, check Fuse F1.

(C) If the fuse is open, unplug the Power Pack (P1) and check for a short to ground at the junction of F1 and C59. If there is a short, remove the Switching Power Supply Module and check the junction of F1 and C59 again for a short. If the short is removed, replace the Switching Power Supply Module.

(D) If the short is still present after the Switching Power Supply is removed, check Diode CR1 and Capacitors C57 and C59 on the System board.

(E) If 17.5V is present at the junction of F1 and C59, check Power Switch (S1). If the Power Switch checks good, replace the Switching Power Supply Module.

(F) Check the CPU IC (UE18), the MON IC (UD18), the Memory Management Unit IC (UE16) and the Input/Output Unit IC (UE14) by substitution.

② VIDEO DISPLAY (Computer)

(A) If there is no video, check Connector J4 on the System board and the video interface cable.

(B) If there is no video or the characters displayed on the screen are not correct, check Character Generator ROM IC (UE4) by substitution.

③ VIDEO DISPLAY (Monitor)

(A) If there is no video, check Connector J1 on the Monitor board and the video interface cable.

(B) Turn the Monitor On and check for 120VAC across the primary winding of Power Transformer (T2). If 120VAC is missing, check Fuse F771, Power Switch (SW1) and Line Choke (L771). Also check for an open power cord.

(C) If Fuse F771 is open, check for a shorted Diode (D701 thru D704) in the DC power supply on the Monitor board.

(D) If 120VAC is present across the primary winding of Power Transformer T2, check for 12.0V on both sides of Fuse F701. If 12.0V is missing on one side of F701, check Fuse F701. If F701 is open, check for a possible short on the load side of the power supply. If no short is found, replace Fuse F701.

(E) If 12.0V is missing from both sides of Fuse F701, check Power Transformer T2 for an open winding. Also check Diodes D701 thru D704 and Regulator Transistor Q701. Adjust B+ Control VR701 for 12.0V at Fuse F701.

(F) Check the voltages on the CRT socket and on the HV anode. Make sure that the CRT socket is making good contact with the CRT pins, especially filament pins 3 and 4. If the CRT voltages are normal, check the CRT with a CRT tester.

(G) If there is no high voltage at the HV anode, check Horizontal Output Transistor Q18.

(H) Check the adjustment of the Sub-Brightness Control (VR503) and the Sub-Contrast Control (VR101).

④ KEYBOARD

(A) If the keyboard is dead or one group of keys does not work, check Connector J9 on the System board and Connector J1 on the keyboard. Also check the keyboard interface cable.

(B) If one key does not work or is erratic, clean the keyswitches with contact cleaner. Use an ohmmeter to check for an open keyswitch.

(C) If the wrong character appears on the Monitor screen when a key is pressed, check the Character Generator ROM IC (UE4) by substitution.

⑤ DISK DRIVE

WARNING
It is possible for a defective Disk Drive to write on or erase information on a diskette even when the diskette is write protected. Check a questionable Disk Drive by first using a diskette that contains programs that have been duplicated on another diskette.

(A) Disk Drive is dead. Check Connector J1 on the Disk Drive and Connector J8 on the System board. Also check the Disk Drive interface cable.

(B) Check for 11.5V at pin 13 of Connector J1, 5.0V at pin 11 of Connector J1, and −11.25V at pin 9 of Connector J1. Also check for a logic Low reading at pin 14 of Connector J1. If the voltages and logic reading are normal, replace or repair the Disk Drive Analog board.

PRELIMINARY SERVICE CHECKS (Continued)

PREVENTATIVE MAINTENANCE

ENVIRONMENT

Computers perform best in a clean, cool area that is below 80 degrees Fahrenheit and free of dust and smoke particles. Even though home Computers are not affected by cigarette smoke as much as commercial Computers are affected, it is better to maintain a smoke-free area around the Computer. Do not block cabinet vents of any of the Computer system; Computer, Monitor, Printer, or other power devices.

ELECTRICAL POWER

Variations in the line voltage can affect the Computer. Try to avoid these fluctuations by using an AC receptacle that is on a power line not used by appliances or other heavy current demand devices. A power-surge protector, power-line conditioner, or non-interruptable power supply may be needed to cure the problem. **Do not** switch power On and Off frequently.

KEYBOARD

Liquids spilled into the Keyboard can ruin it. Immediately after a spill occurs, disconnect the Computer power plug from AC power outlet. Then, if circuitry or contacts are contaminated, disassemble the Keyboard and carefully rinse the Keyboard printed circuit board with distilled water and let it dry. Use a cotton swab to clean between the keys. Use a non-abrasive contact cleaner and lint-free wipers on accessible connectors and contacts.

DISK DRIVES

Clean the read/write heads of the Disk Drives about once a month or after 100 hours usage. Use only an approved head cleaning kit.

Handle carefully to preserve proper disk head alignment. A sudden bump or jolt to the Disk Drives can knock the disk head out of alignment. If the disk drive must be transported, place an old disk in slot and close door during transport.

Store disks in their protective covers and never touch the disk surface. Observe the disk handling precautions usually found on the back of disk protective covers.

PRINTERS

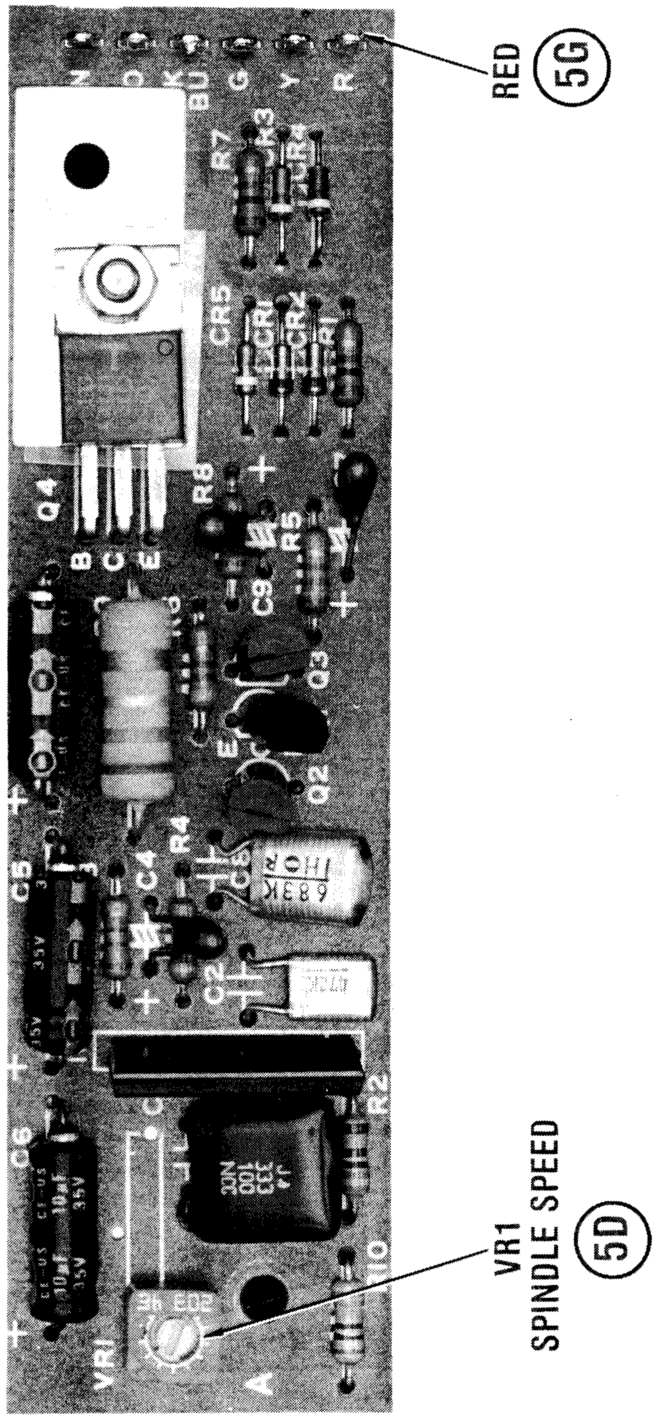
Carefully vacuum the Printer regularly. Wipe surface areas clean using a light all-purpose cleaner. Do not oil the machine. The oil will collect abrasive grit and dust. The dust will act as a blanket. This can cause components to overheat and fail.

STATIC ELECTRICITY

Static electricity discharge can affect the Computer. In order to minimize the possibility, use anti-static mats, sprays, tools and materials, and maintain good humidity in the Computer environment.

MONITOR

Use an isolation transformer with any Monitor that does not come as part of the system since some Monitors use a HOT chassis (chassis connected to one side of the AC line). The face of the Monitor should never be left on for long periods of time at high brightness level except when pattern is being changed periodically. Use caution when cleaning anti-glare screens, to preserve the glare-reduction feature.



DISK DRIVE MOTOR SPEED CONTROL BOARD

SERVICE CHECKS (Continued)

(C) Disk Drive operation is erratic. Check Connector J8 on the System board and Connector J1 on the Disk Drive.

(D) Clean the head and check the Spindle Speed Adjustment (VR1), see "Miscellaneous Adjustments".

(E) Will not write or read. Check Connector J3 on the Disk Drive Analog board for good connections. It may be necessary to repair or replace the Disk Drive Analog board.

(F) Writes on a write protected diskette. Check for a shorted write protect sensor. It may be necessary to repair or replace the Disk Drive Analog board.

(G) Disk Drive will not run. Check fo a broken drive belt. Check for approximately 6.3V at the red Drive Motor lead on the Motor Speed Control board. If the voltage is present, check the Drive Motor by substitution. If the voltage is missing, it may be necessary to replace or repair the Motor Speed Control board.

⑥ INTERNAL SPEAKER

(A) No sound. Check the Speaker (SP1), Connector J10 and the Earphone jack (J7) for good connections.

⑦ SERIAL PORT 1 (PRINTER PORT)

(A) If Serial Port is not working, check Connector J6 for good connections.

⑧ SERIAL PORT 2 (MODEM)

(A) If Serial Port 2 is not working, check Connector J12 for good connection.

⑨ GAME PADDLES

(A) Type in and run the following Basic program to check the operation of the game paddle circuits.

```
10 HOME
20 PRINT "PADDLE 0", PDL(0)
30 PRINT "PADDLE 1", PDL(1)
40 FOR T=1 TO 300: NEXT T
50 GOTO 10
```

This program scans the two paddles and displays the paddle numbers (0 and 1) on the Monitor screen along with a number that is read from each paddle. The number that is read from each paddle should vary between 0 and 255 as the paddle is varied from MINIMUM to MAXIMUM.

(B) If the paddles are not functioning, check Connector J3 for good connections.

(C) Check for pulses at pin 6 of the Paddle IC (UF2) and at pin 7 of the MUX IC (UF3). If the pulses are missing at either pin 6 of UF2 or pin 7 of UF3, check the MMU (Memory Management Unit) IC (UE16) by substitution.

(D) If the pulses are present at pin 6 of IC UF2 and pin 7 of IC 3F and the paddles are not functioning, check the IOU (Input/Output Unit) IC (UE14) by substitution.

⑩ MOUSE

(A) Type in and run the following Basic program to check the Mouse circuits. NOTE: This program will not work with PRODOS.

```
10 PR#4: PRINT CHRS(1)
20 IN#4
30 INPUT " "; X,Y,B
40 IN#0: PR#0
50 HOME
60 PRINT "X", "Y", "BUTTON"
70 PRINT X,Y,B
80 FOR T=1 TO 300: NEXT T
90 GOTO 30
```

This program will print the X and Y coordinates (0 to 1023) and the button Status (4 = button released, 3 = button just released, 2 = button just pressed, and 1 = button held down) on the Monitor screen. The button Status number will be negative if a key on the keyboard is pressed.

(B) If the Mouse is not working, check Connector J3 for good connections. Also check the mouse cable.

(C) With the above program running, check for pulses at pin 7 of MUX (Multiplexer) IC (UF3). If the pulses are missing at pin 7 of UF3, check the MMU (Memory Management Unit) IC (UE16) by substitution.

(D) If the pulses are present at pin 7 of IC UF3, check IOU (Input/Output Unit) IC (UE14) by substitution.

SERVICE CHECKS (Continued)

⑪ JOYSTICKS

(A) Type in and run the following Basic program to check the operation of the joystick circuits.

```
10 HOME
20 PRINT "X POSITION", PDL(0)
30 PRINT "Y POSITION", PDL(1)
40 PRINT "SWITCH 0 = ", PEEK (– 16287)
50 PRINT "SWITCH 1 = ", PEEK (– 16286)
60 FOR T = 1 TO 300: NEXT T
70 GOTO 10
```

This program scans the joystick circuit and displays "X POSITION" and "Y POSITION", each followed by a number from 0 to 255. Also displayed on the Monitor is "SWITCH 0" and "SWITCH 1", each followed by a number. When the joystick is moved to the extreme right, the "X POSITION" will read 255 and it will read 0 when the joystick is moved to the extreme left. When the joystick is moved to the extreme lower position, the "Y POSITION" will read 255 and will read 0 when the joystick is at the top. The number displayed after "SWITCH 0" and "SWITCH 1" will be 127 or less until the pushbutton is pressed. When the left pushbutton is pressed "SWITCH 0" will read 128 or more and "SWITCH 1" will read 128 or more when the top pushbutton is pressed.

(B) If the joystick inputs are not functioning, check Connector J3 for good connections. Also check the joystick cable.

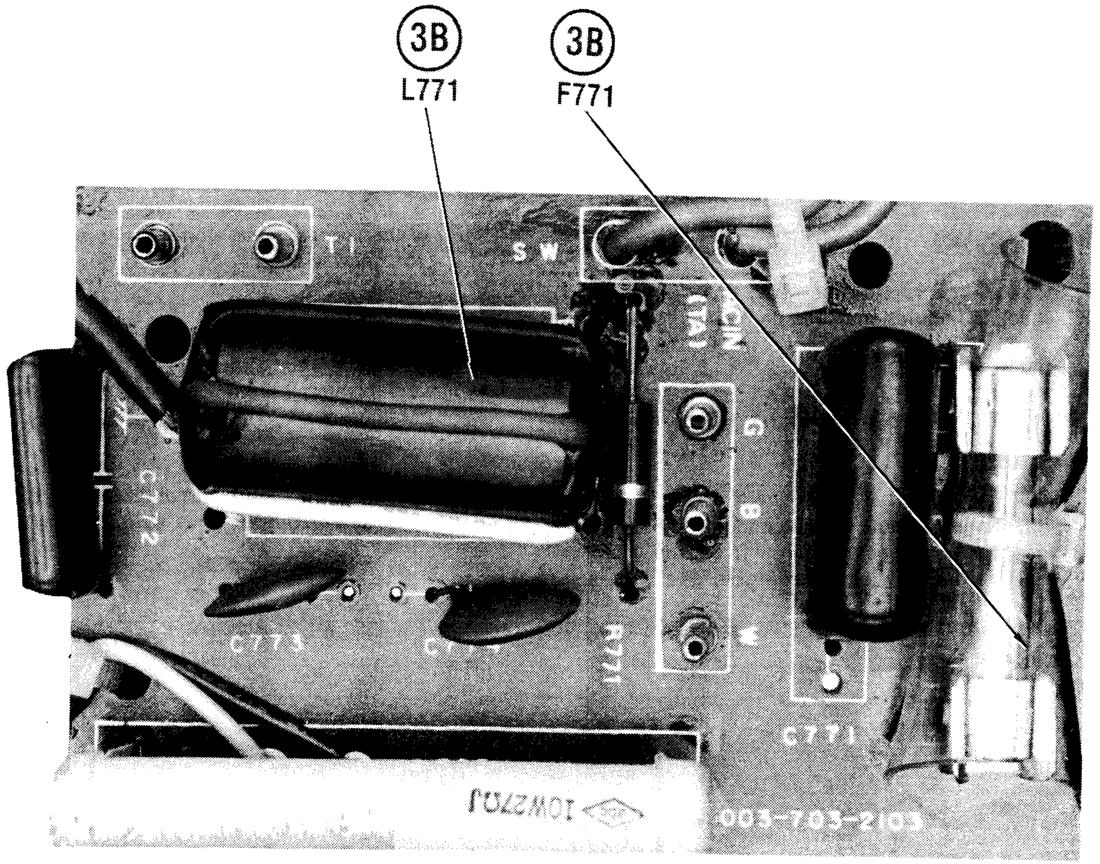
(C) With the above program running, check for pulses at pin 6 of the Paddle IC (UF2) and at pin 7 of the MUX (Multiplexer) IC (UF3). If the pulses are missing at either pin 6 of UF2 or pin 7 of UF3, check the MMU (Memory Management Unit) IC (UE16) by substitution.

(D) If pulses are present at pin 6 of IC UF2 and at pin 7 of IC UF3 and the joysticks are not functioning, check the IOU (Input/Output Unit) IC (UE14) by substitution.

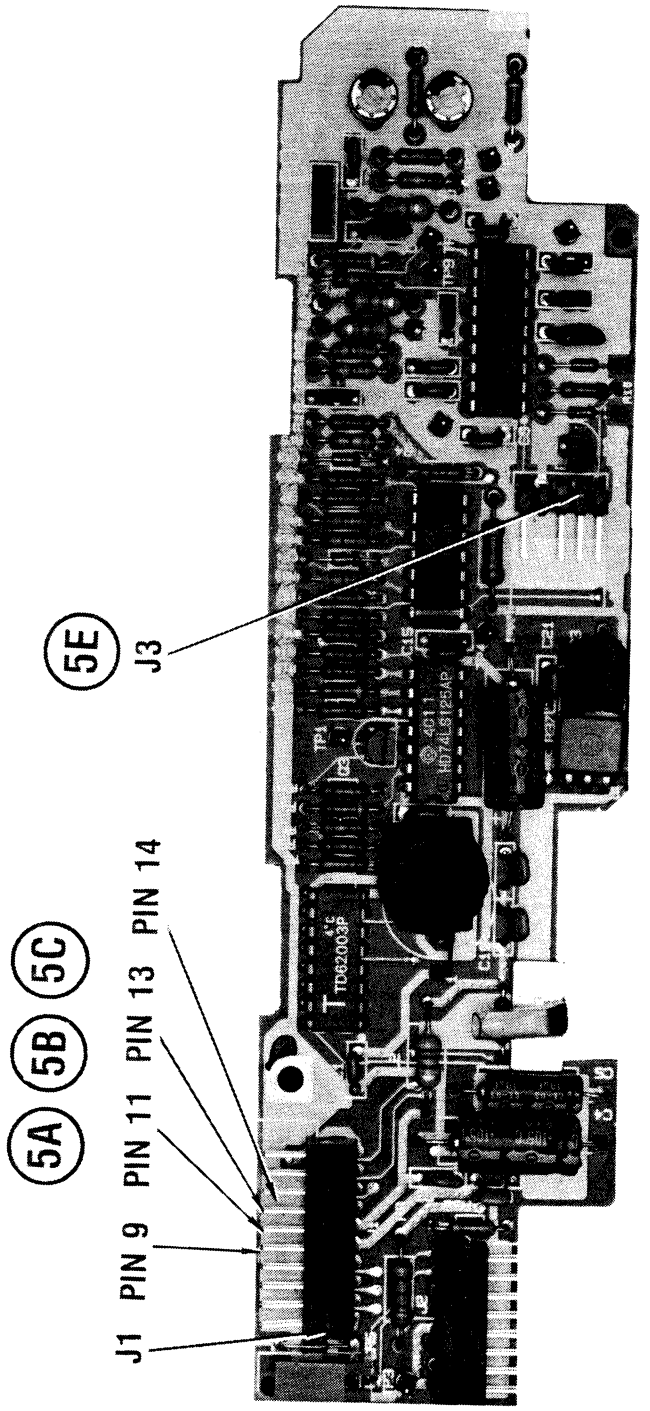
(E) With the above program running, check for pulses at pins 5 and 9 of Paddle IC (UF2). If the pulses are present at both pins 5 and 9 of IC UF2, check the IOU (Input/Output Unit) IC (UE14) by substitution.

⑫ LOW POWER MONITOR

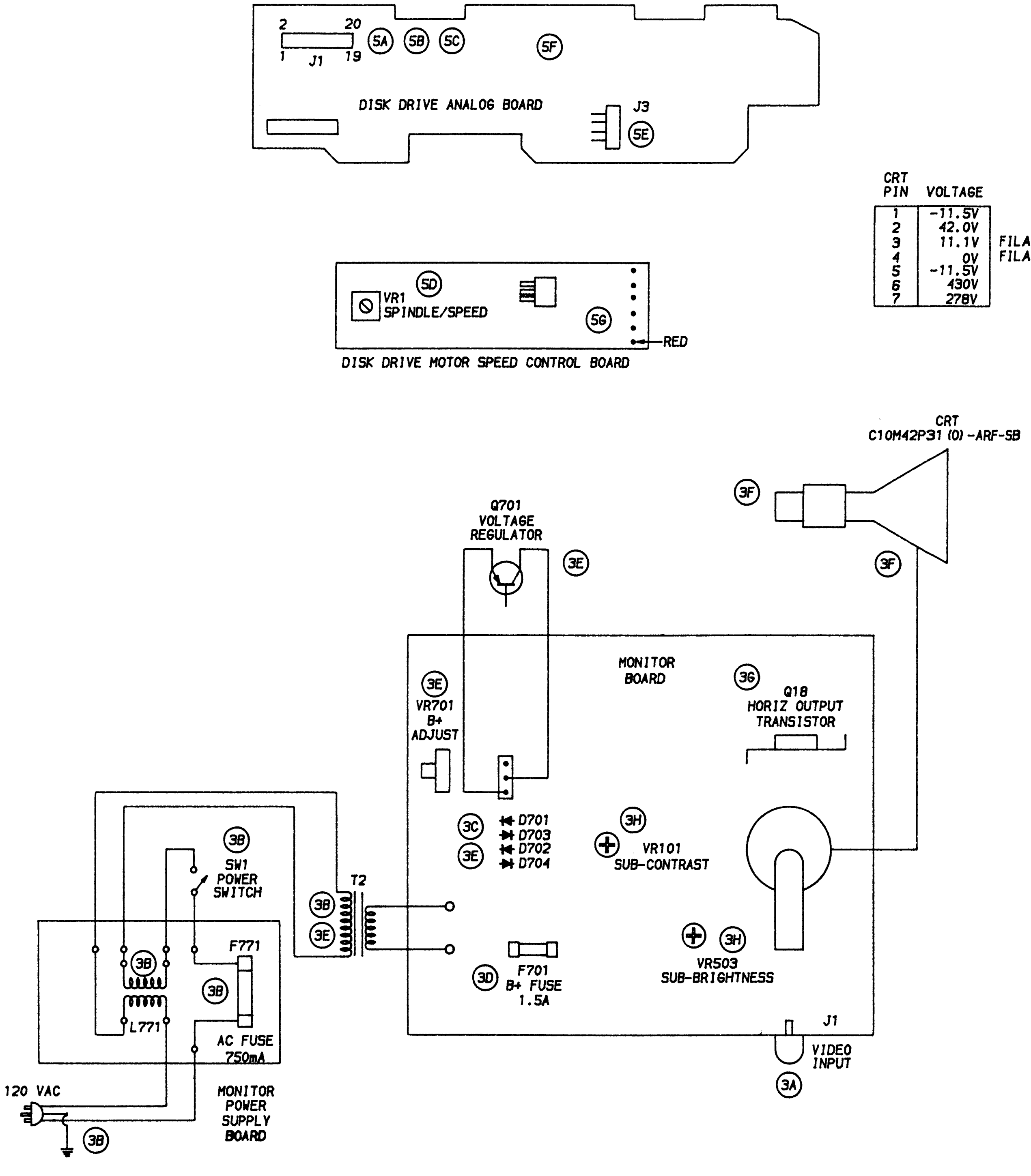
(A) If the green Power LED is flashing, check the DC power at pin 5 of Power Connector J1. If the voltage is below 10V, replace or repair the Power Pack. If the voltage is above 10V, the Low Power Detector circuit is defective.



MONITOR POWER SUPPLY BOARD

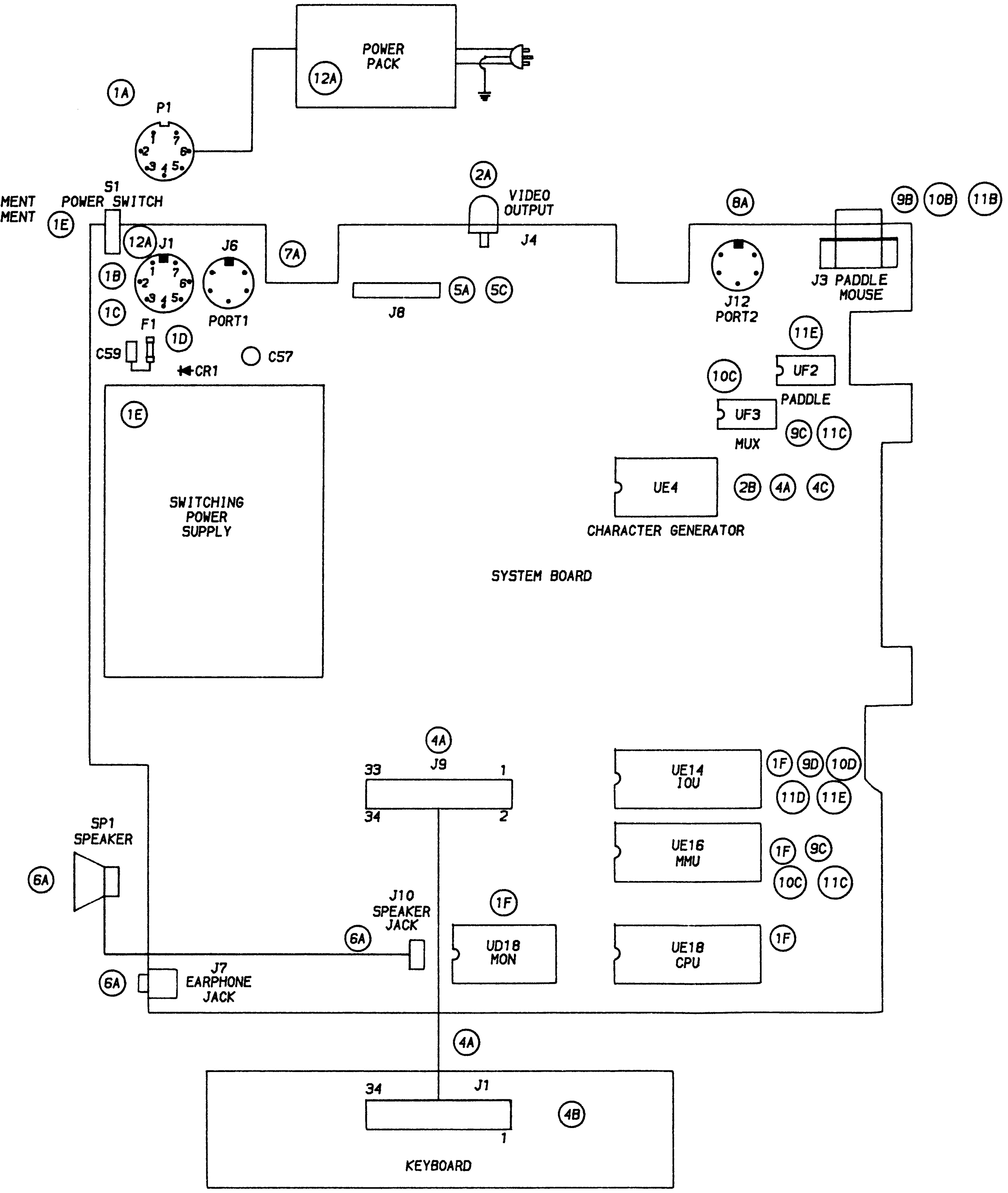


DISK DRIVE ANALOG BOARD


2
20
1
J1
19
5A
5B
5C
5F
DISK DRIVE ANALOG BOARD
J3
5E
5D
VR1
SPINDLE/SPEED
5G
RED
DISK DRIVE MOTOR SPEED CONTROL BOARD
CRT
C10M42P31 (0) -ARF-SB
3F
3F
Q701
VOLTAGE
REGULATOR
3E
MONITOR
BOARD
3E
VR701
B+
ADJUST
3G
Q18
HORIZ OUTPUT
TRANSISTOR
3C
D701
D703
D702
D704
3E
3H
VR101
SUB-CONTRAST
3B
SW1
POWER
SWITCH
T2
3B
3E
3B
F771
3B
L771
AC FUSE
750mA
3D
F701
B+ FUSE
1.5A
3H
VR503
SUB-BRIGHTNESS
J1
VIDEO
INPUT
3A
120 VAC
3B
MONITOR
POWER
SUPPLY
BOARD

CRT PIN	VOLTAGE	
1	-11.5V	
2	42.0V	
3	11.1V	FILAMENT
4	0V	FILAMENT
5	-11.5V	
6	430V	
7	278V	

INTERCONNECTING DIAGRAM


POWER
PACK
12A
1A
P1
1
7
2
6
3
4
5
S1
POWER SWITCH
1E
12A
J1
J6
1B
1C
PORT1
F1
1D
C59
C57
CR1
7A
2A
VIDEO
OUTPUT
J4
J8
5A
5C
8A
J12
PORT2
9B
10B
11B
J3 PADDLE
MOUSE
11E
UF2
10C
PADDLE
UF3
MUX
9C
11C
1E
SWITCHING
POWER
SUPPLY
UE4
2B
4A
4C
CHARACTER GENERATOR
SYSTEM BOARD
4A
33
J9
1
34
2
UE14
IOU
1F
9D
10D
11D
11E
SP1
SPEAKER
6A
UE16
MMU
1F
9C
10C
11C
J10
SPEAKER
JACK
6A
1F
UD18
MON
UE18
CPU
1F
6A
J7
EARPHONE
JACK
4A
34
J1
1
4B
KEYBOARD

INTERCONNECTING DIAGRAM

PRELIMINARY SERVICE CHECKS (Continued)
MISCELLANEOUS ADJUSTMENTS

DISK DRIVE

MOTOR SPEED ADJUSTMENT

Run the following program to keep the Disk Drive running continuously.

```
10 X = PEEK (– 16151): X = PEEK (– 16150)
```

Insert a diskette into the Disk Drive and close the door. Set the Disk Drive on its side so the strobe pattern on the spindle pulley is visible. Use a fluorescent light to view the strobe pattern. Use the outside pattern if a 60 cycle light is being used or the inside pattern if a 50 cycle light is being used. Adjust the Speed Control (VR1) until the strobe pattern appears to stand still.

MONITOR BOARD

ALIGNMENT TOOLS	GC ELECTRONICS
L503	5000, 5009, 8276
L505	9440, 8282, 8606

NOTE: Pattern generator with 1Vp-p into 75 ohms (VTR Standard) output used with appropriate pattern.

INITIAL MONITOR TEST

Connect a crosshatch generator to the Video In Jack. Turn the Monitor On and adjust the Brightness and Contrast controls for the best display. Check the adjustment of the Vert Hold, Horiz Hold, Vert Lin, Vert Size and Focus controls. If any of these controls produce erratic operation, clean that control with contact cleaner and recheck.

ADJUSTMENTS

NOTE: Connect a crosshatch generator to the Video In Jack for the following adjustments.

FOCUS ADJUSTMENT

Adjust the Focus Control (VR502) for sharp, well defined lines on the display.

VERT AND HORIZ HOLD ADJUSTMENT

Adjust the Vert Hold Control (VR401) and Horiz Hold Control (VR501) for the most stable display.

VERT SIZE ADJUSTMENT

Adjust the Vert Size Control (VR403) for the desired height on the display.

VERT LIN ADJUSTMENT

Adjust the Vert Lin Control (VR402) for even spacing between the vertical lines on the display.

VOLTAGE REGULATOR ADJUSTMENT

Connect a voltmeter to the collector of Voltage Regulator Transistor (Q701). Adjust the Voltage Regulator Control (VR701) for 12.0V.

SUB BRIGHTNESS ADJUSTMENT

Connect a crosshatch generator to the Video In Jack. Set the Brightness and Contrast Controls to Maximum clockwise position.

Adjust the Sub Brightness Control (VR503) for Maximum brightness without retrace lines.

CENTERING ADJUSTMENT

Center the CRT display by adjusting the two magnetic centering rings located on the deflection yoke rear cover.

HORIZ LIN ADJUSTMENT

Adjust the Horiz Lin Coil (L503) for even spacing between the horizontal lines on the display.

WIDTH ADJUSTMENT

Adjust the Width Coil (L505) for the desired width on the display.

SUB CONTRAST

Set the Brightness and Contrast Controls to Maximum clockwise position. Adjust the Sub Contrast Control for best display with no distortion.

SYSTEM BOARD

ALIGNMENT TOOLS

	GC ELECTRONICS
L2	9300, 9302, 9304

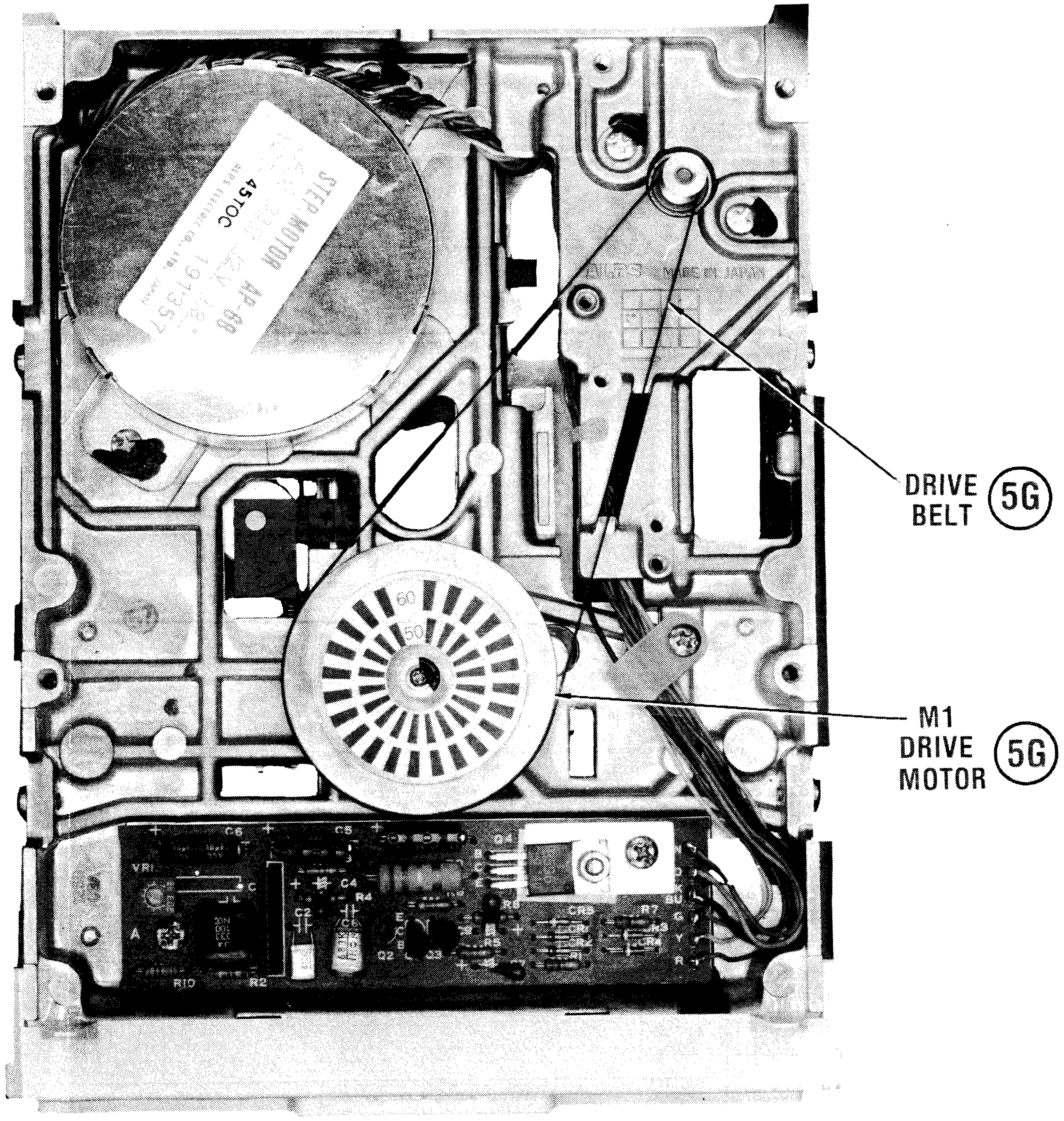
HUE ADJUST

Type in and run the following Basic program.

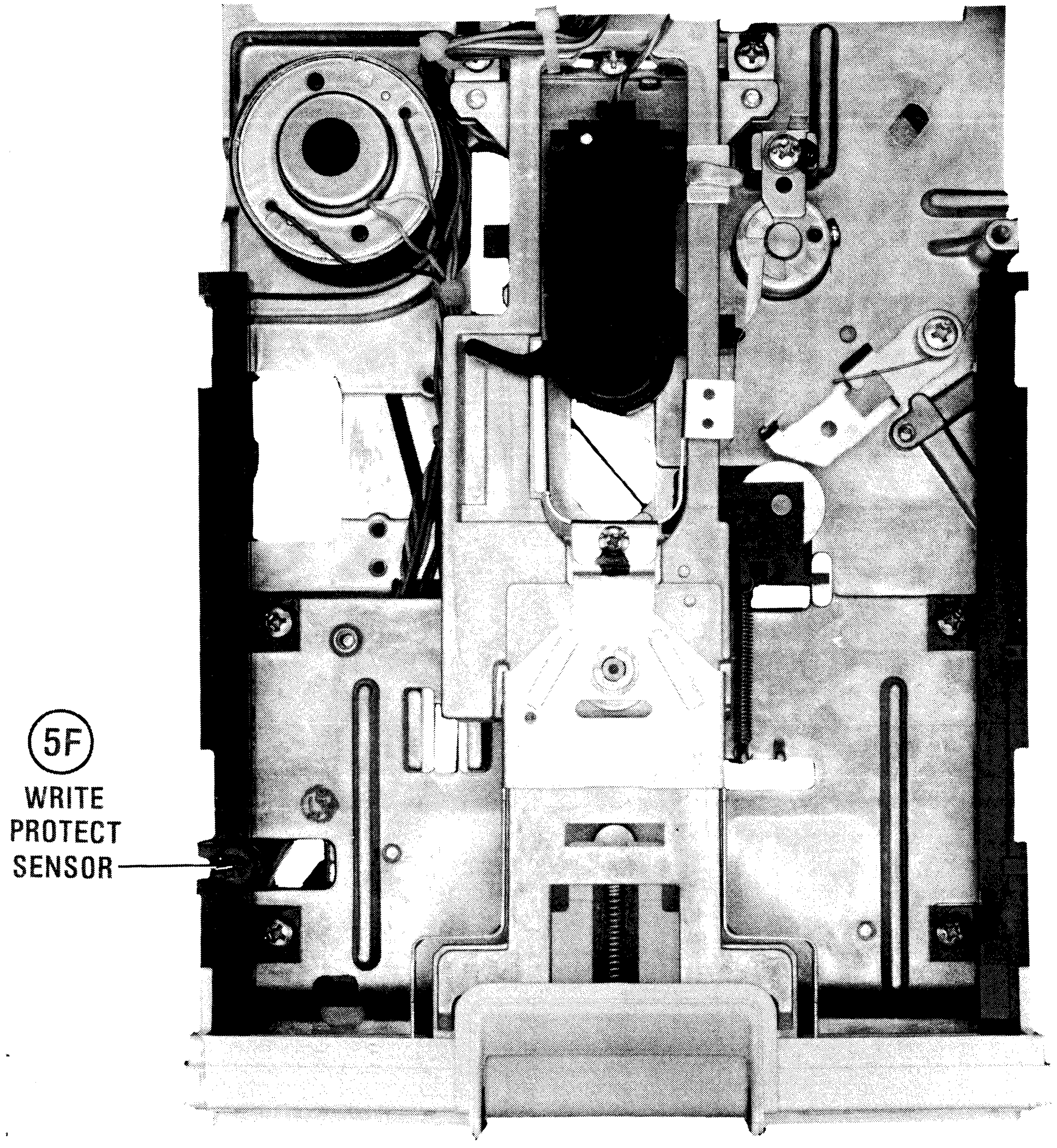
```
10 GR
20 FOR X = 20 TO 22
30 READ Y: COLOR = Y
40 HLIN 0,39 AT X: NEXT X
50 DATA 2,9,12
```

The program produces blue, orange and green lines on a color Monitor screen. Adjust Hue Adjust Coil (L2) for proper blue, orange and green hues.

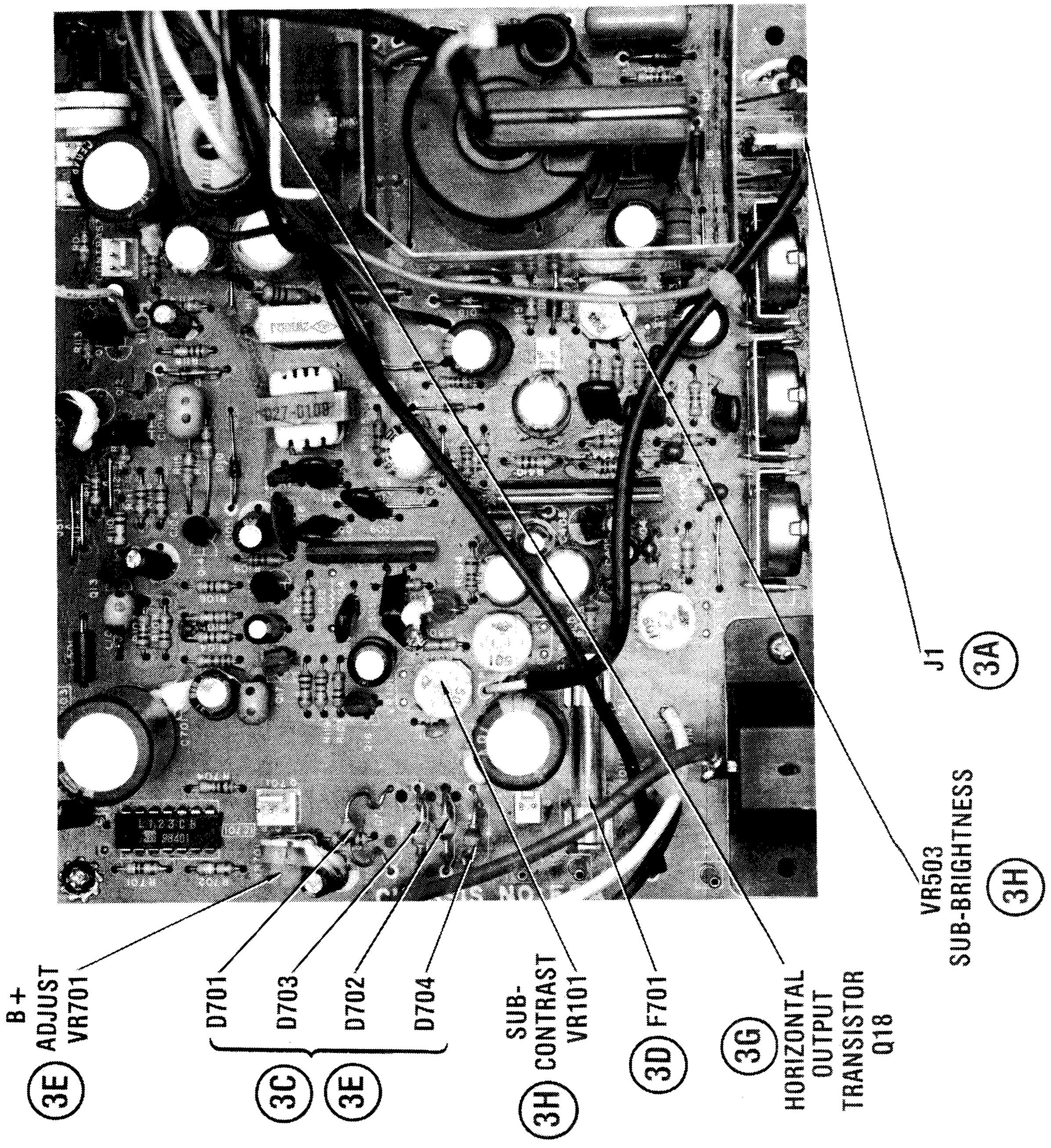
PRELIMINARY SERVICE CHECKS (Continued)



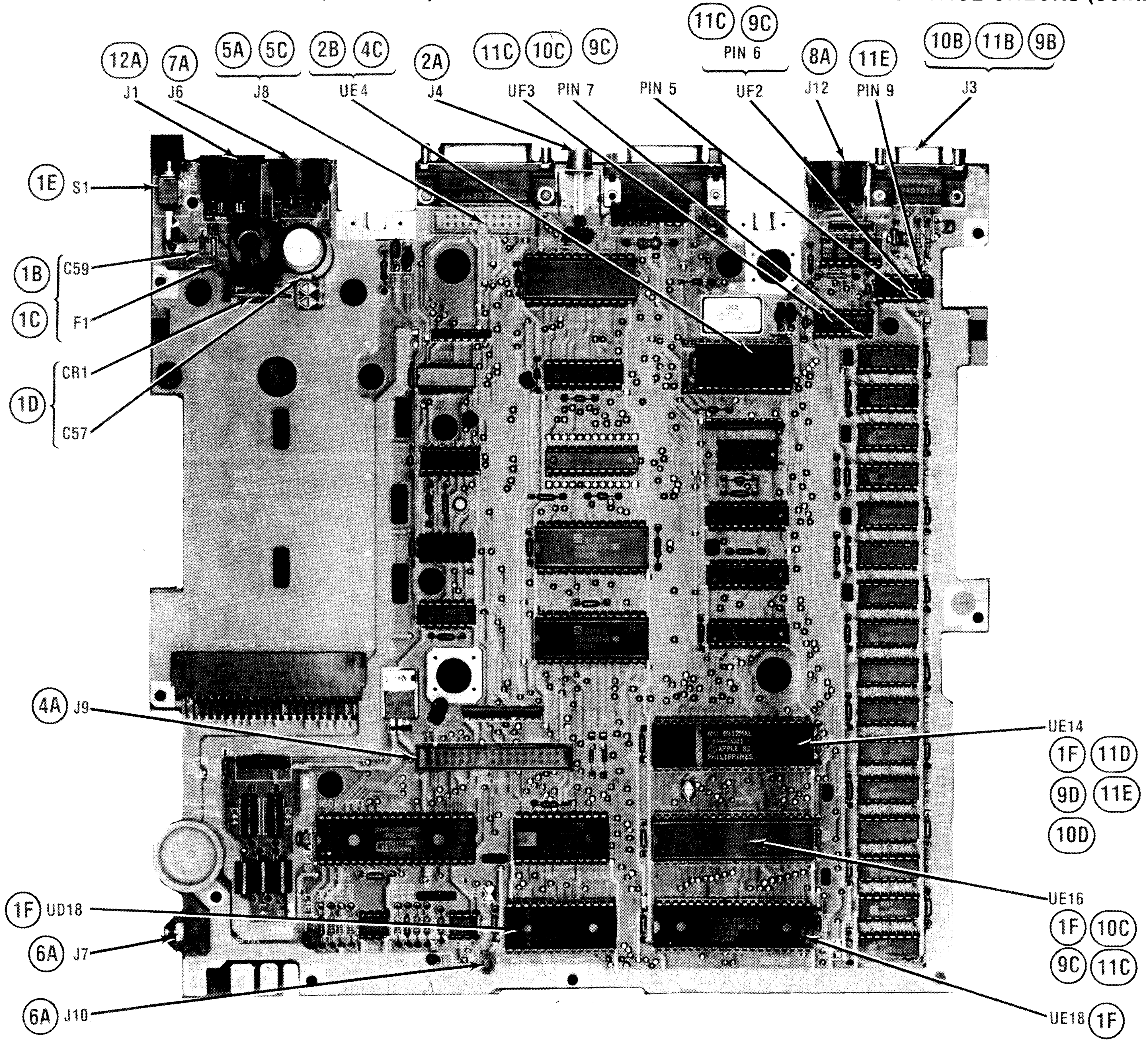
MECHANICAL-BOTTOM VIEW

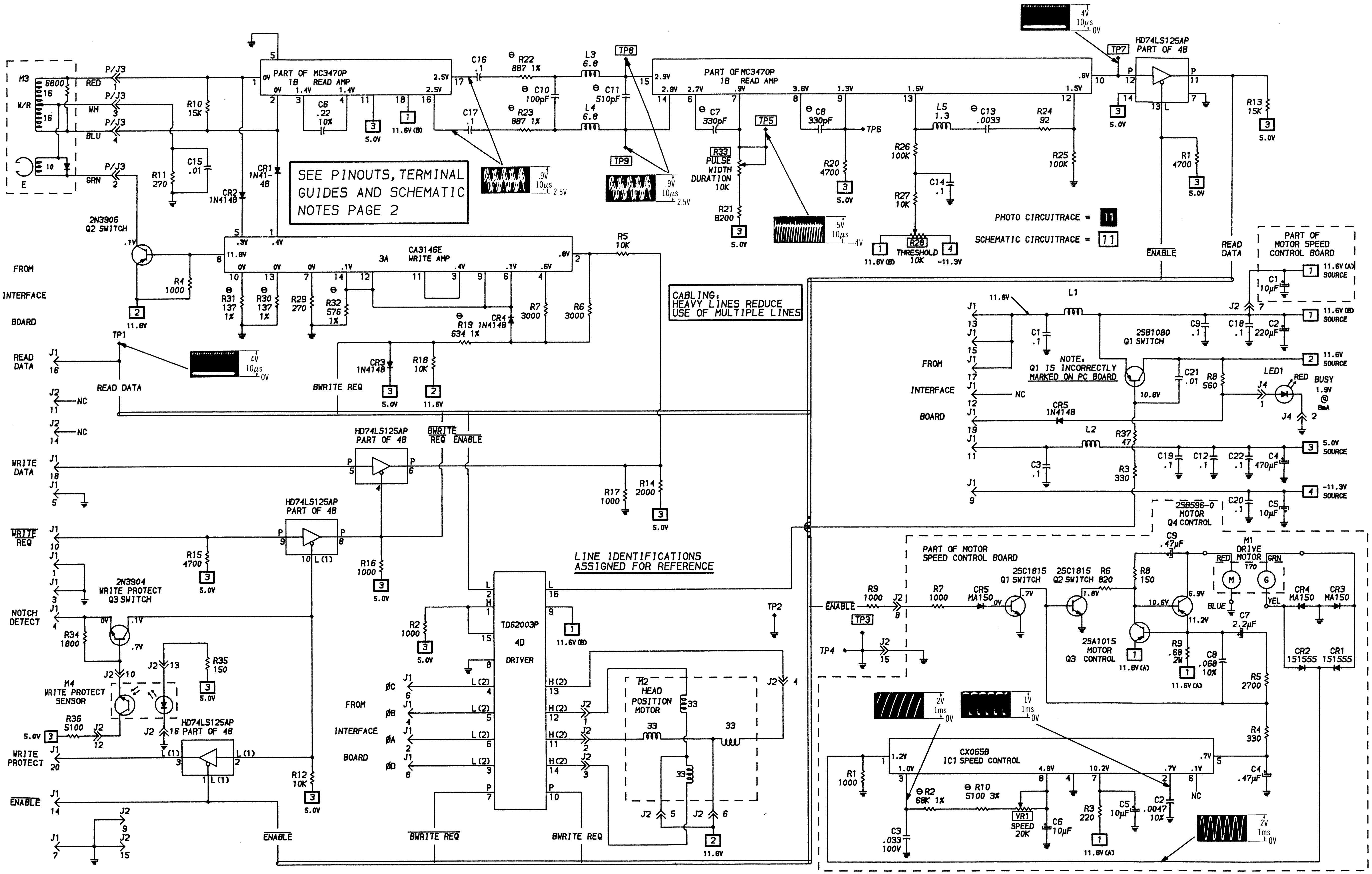

5F
WRITE PROTECT SENSOR

MECHANICAL-TOP VIEW


3E
B+ ADJUST VR701
D701
D703
D702
D704
3C
3E
3H
SUB-CONTRAST VR101
3D
F701
3G
HORIZONTAL OUTPUT TRANSISTOR Q18
3H
VR503 SUB-BRIGHTNESS
3A
J1

MONITOR BOARD


12A
J1
7A
J6
5A 5C
J8
2B 4C
UE4
2A
J4
11C 10C 9C
UF3
PIN 7
PIN 5
11C 9C
PIN 6
UF2
8A
J12
11E
PIN 9
10B 11B 9B
J3
1E S1
1B C59
1C F1
CR1
1D
C57
4A J9
1F UD18
6A J7
6A J10
UE14
1F 11D
9D 11E
10D
UE16
1F 10C
9C 11C
UE18 1F


M3
W/R
E
P/J3
RED
WH
BLU
GRN
R10 15K
R11 270
C15 .01
CR1 1N41-48
CR2 1N4148
PART OF MC3470P 1B READ AMP
C6 .22 10%
C16 .1
C17 .1
R22 887 1%
R23 887 1%
C10 100pF
L3 6.8
L4 6.8
C11 510pF
TP8
TP9
PART OF MC3470P 1B READ AMP
C7 330pF
C8 330pF
TP6
R33 PULSE WIDTH DURATION 10K
R21 8200
TP5
R20 4700
L5 1.3
C13 .0033
R24 92
R25 100K
R26 100K
R27 10K
C14 .1
R28 THRESHOLD 10K
TP7
HD74LS125AP PART OF 4B
R13 15K
R1 4700
ENABLE
READ DATA
2N3906 Q2 SWITCH
CA3146E 3A WRITE AMP
R4 1000
R31 137 1%
R30 137 1%
R29 270
R32 576 1%
R19 1N4148 634 1%
CR4
R7 3000
R6 3000
R5 10K
CR3 1N4148
R18 10K
BWRITE REQ
FROM INTERFACE BOARD
READ DATA
TP1
HD74LS125AP PART OF 4B
BWRITE REQ
ENABLE
WRITE DATA
R17 1000
R14 2000
WRITE REQ
R15 4700
R16 1000
2N3904 WRITE PROTECT Q3 SWITCH
NOTCH DETECT
R34 1800
M4 WRITE PROTECT SENSOR
R35 150
R36 5100
HD74LS125AP PART OF 4B
WRITE PROTECT
R12 10K
ENABLE
TD62003P 4D DRIVER
R2 1000
FROM INTERFACE BOARD
ØC
ØB
ØA
ØD
M2 HEAD POSITION MOTOR
BWRITE REQ
TP2
TP4
TP3
L1
2SB1080 Q1 SWITCH
C1 .1
C9 .1
C18 .1
C2 220µF
C21 .01
R8 560
LED1 RED BUSY 1.9V @ 8mA
CR5 1N4148
L2
R37 47
C3 .1
C19 .1
C12 .1
C22 .1
C4 470µF
R3 330
C20 .1
C5 10µF
PART OF MOTOR SPEED CONTROL BOARD
C1 10µF
2SB596-0 MOTOR Q4 CONTROL
11.6V SOURCE
5.0V SOURCE
-11.3V SOURCE
PART OF MOTOR SPEED CONTROL BOARD
R9 1000
R7 1000
CR5 MA150
2SC1815 Q1 SWITCH
2SC1815 Q2 SWITCH
R6 820
R8 150
C9 .47µF
M1 DRIVE MOTOR 170
RED
GRN
BLUE
YEL
CR4 MA150
CR3 MA150
CR2 1S1555
CR1 1S1555
2SA1015 MOTOR Q3 CONTROL
R9 .68 2W
C8 .068 10%
C7 2.2µF
R5 2700
R4 330
C4 .47µF
CX065B IC1 SPEED CONTROL
R1 1000
R2 68K 1%
R10 5100 3%
VR1 SPEED 20K
C6 10µF
R3 220
C5 10µF
C2 .0047 10%
C3 .033 100V
NC
2V 1ms 0V
1V 1ms 0V
4V 10µs 0V
.9V 10µs 2.5V
5V 10µs -4V

SEE PINOUTS, TERMINAL GUIDES AND SCHEMATIC NOTES PAGE 2

PHOTO CIRCUITRACE = 11

SCHEMATIC CIRCUITRACE = 11

CABLING: HEAVY LINES REDUCE USE OF MULTIPLE LINES

NOTE: Q1 IS INCORRECTLY MARKED ON PC BOARD

LINE IDENTIFICATIONS ASSIGNED FOR REFERENCE

- —×— Circuitry not use
- - - - Circuitry used ir
- ⊖ See parts list
- ⏚ Ground
- Chassis

Waveforms and otherwise

Voltages, logic r Drive while runr and during the p noted. An initia programs or data Caps Lock key i

```
10 DS=CHRS(4
20 PRINT DS; "(
30 PRINT DS; "\
40 FOR X=1 TC
50 PRINT "THIS
60 NEXT X
70 PRINT DS; "(
80 GOTO 20
```

A PHOTOFACT STANDARD NOTATION SCHEMATIC WITH CIRCUITRACE

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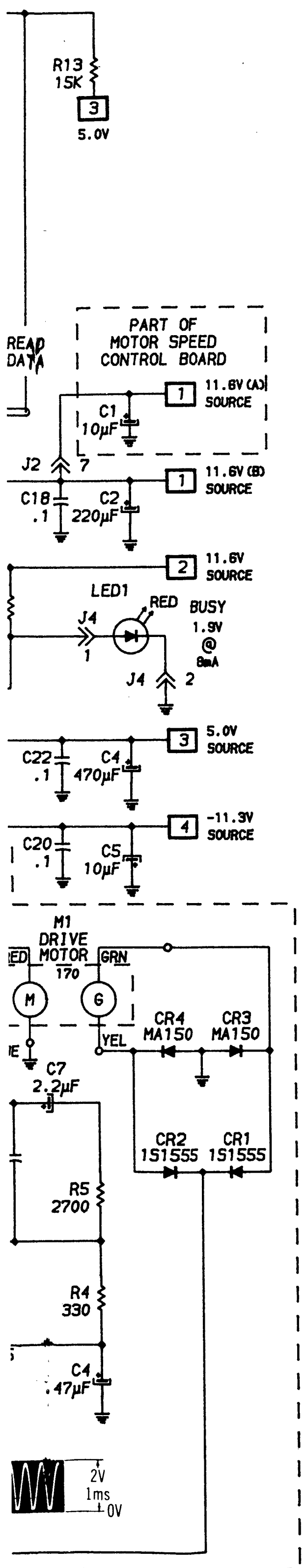
DISK DRIVE

APPLE MODEL IIc

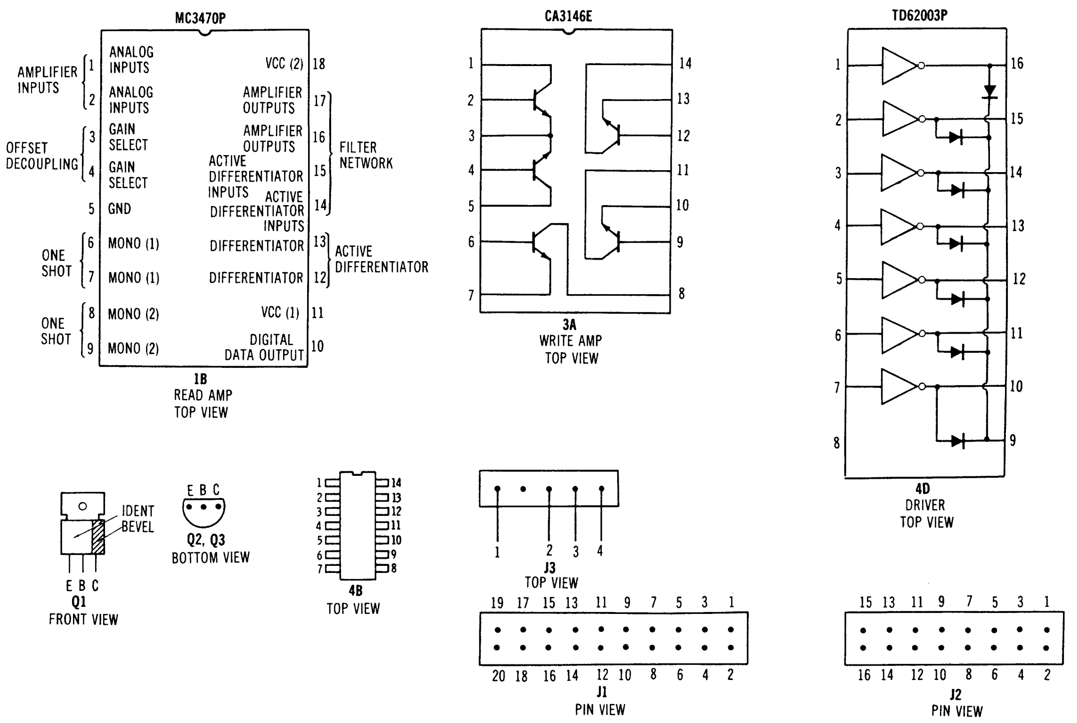

R13
15K
3
5.0V
READ DATA
PART OF MOTOR SPEED CONTROL BOARD
1 11.6V (A) SOURCE
C1 10µF
J2 7
C18 .1
C2 220µF
1 11.6V (B) SOURCE
2 11.6V SOURCE
LED1
RED BUSY 1.9V @ 8mA
J4 1
J4 2
C22 .1
C4 470µF
3 5.0V SOURCE
C20 .1
C5 10µF
4 -11.3V SOURCE
M1 DRIVE MOTOR 170
GRN
M
G
YEL
CR4 MA150
CR3 MA150
C7 2.2µF
CR2 1S1555
CR1 1S1555
R5 2700
R4 330
C4 .47µF
2V
1ms
0V

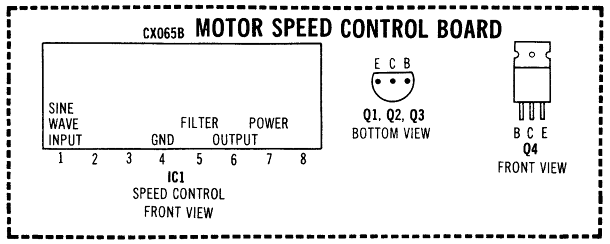
APPLE
MODEL IIc

DRIVE

IC PINOUTS, TERMINAL GUIDES & SCHEMATIC NOTES

TERMINAL GUIDES


MC3470P
AMPLIFIER INPUTS
1 ANALOG INPUTS
2 ANALOG INPUTS
OFFSET DECOUPLING
3 GAIN SELECT
4 GAIN SELECT
5 GND
ONE SHOT
6 MONO (1)
7 MONO (1)
ONE SHOT
8 MONO (2)
9 MONO (2)
VCC (2) 18
AMPLIFIER OUTPUTS 17
AMPLIFIER OUTPUTS 16
ACTIVE DIFFERENTIATOR INPUTS 15
ACTIVE DIFFERENTIATOR INPUTS 14
FILTER NETWORK
DIFFERENTIATOR 13
DIFFERENTIATOR 12
ACTIVE DIFFERENTIATOR
VCC (1) 11
DIGITAL DATA OUTPUT 10
1B
READ AMP
TOP VIEW
CA3146E
3A
WRITE AMP
TOP VIEW
TD62003P
4D
DRIVER
TOP VIEW
IDENT BEVEL
E B C
Q1
FRONT VIEW
E B C
Q2, Q3
BOTTOM VIEW
4B
TOP VIEW
J3
TOP VIEW
J1
PIN VIEW
J2
PIN VIEW


CX065B MOTOR SPEED CONTROL BOARD
SINE WAVE INPUT
GND
FILTER OUTPUT
POWER
1 2 3 4 5 6 7 8
IC1
SPEED CONTROL
FRONT VIEW
E C B
Q1, Q2, Q3
BOTTOM VIEW
B C E
Q4
FRONT VIEW

SCHEMATIC NOTES

- ⇸ Circuitry not used in some versions
- - - - Circuitry used in some versions
- ⊖ See parts list
- ⏚ Ground
- ⫫ Chassis

Waveforms and voltages taken from ground, unless noted otherwise

Voltages, logic readings and waveforms taken on the Disk Drive while running the following program (with DOS 3.3) and during the period when the Head is not moving unless noted. An initialized diskette, with DOS 3.3 only (no other programs or data), was used in the Disk Drive. Note: Put the Caps Lock key in the down position.

```
10 DS = CHRS(4)
20 PRINT DS; "OPEN SAMS"
30 PRINT DS; "WRITE SAMS"
40 FOR X = 1 TO 50
50 PRINT "THIS IS A TEST"
60 NEXT X
70 PRINT DS; "CLOSE"
80 GOTO 20
```

Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on 0 reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7 cm. width with DC reference voltage given at the bottom line of each waveform.

Time in µsec. per cm, given with p-p reading at the end of each waveform.

Item numbers in rectangles appear in the alignment/adjustment instructions.

Supply voltages maintained as shown at input.

Controls adjusted for normal operation.

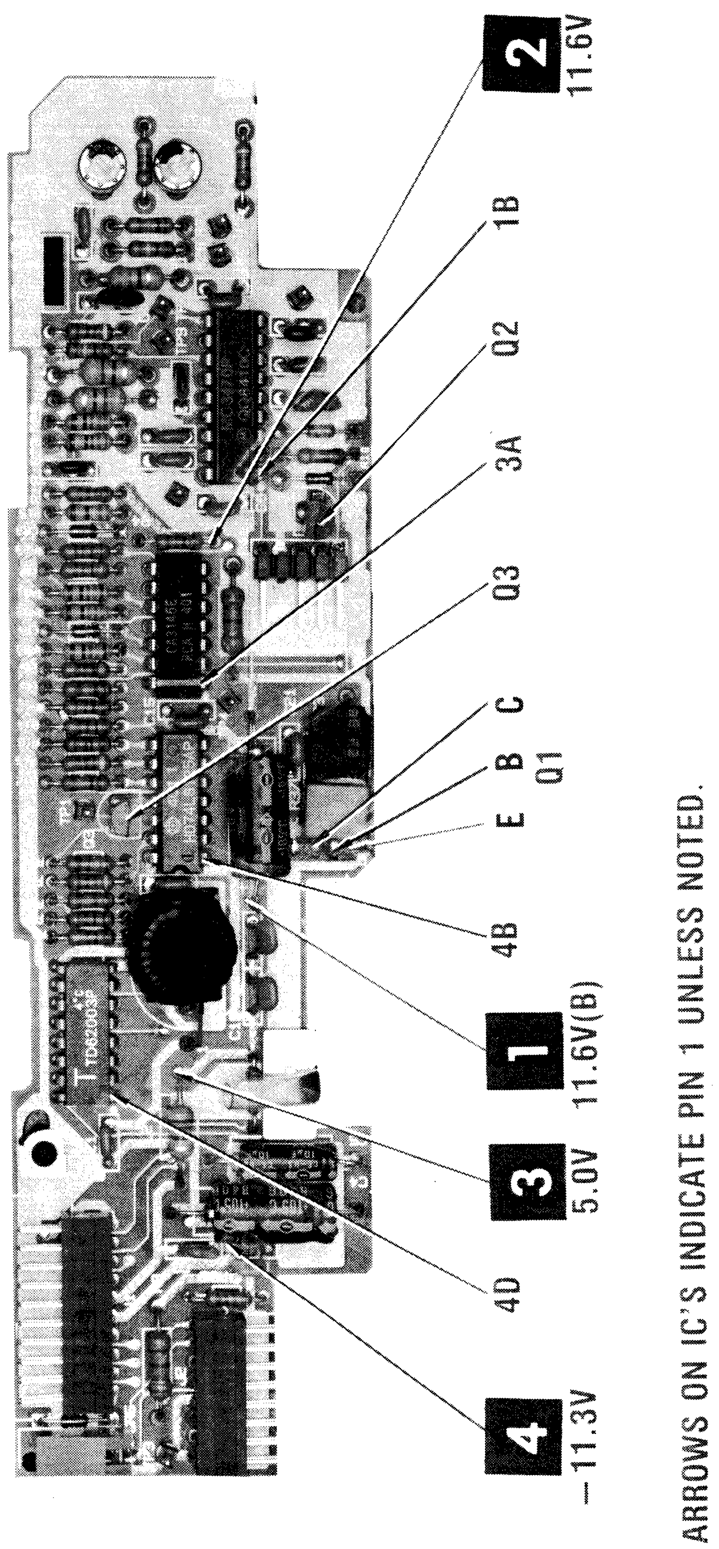
Terminal identification may not be found on unit.

Capacitors are 50 volts or less, 5% unless noted.

Electrolytic capacitors are 50 volts or less, 20% unless noted.

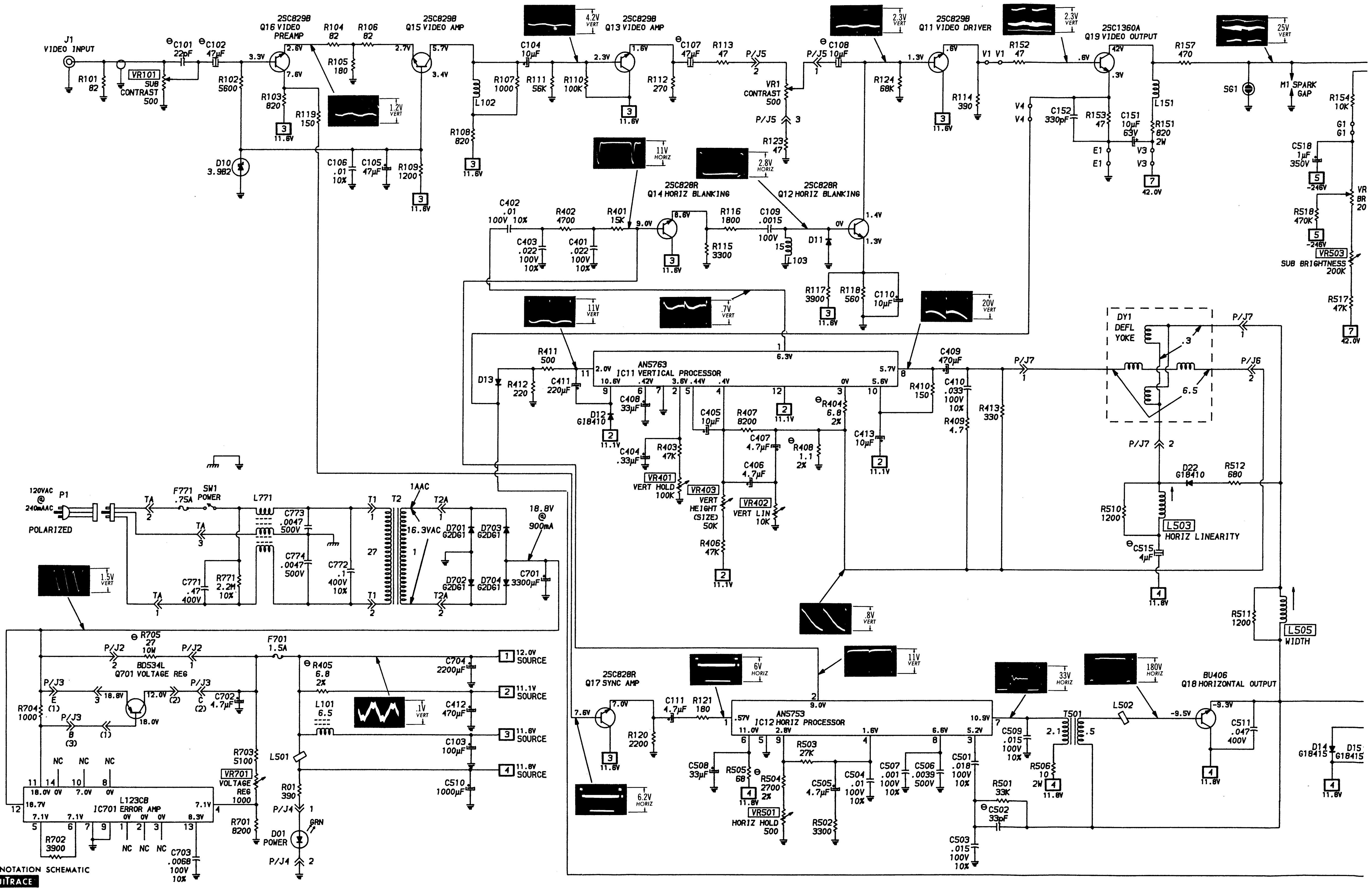
Resistors are ½W or less, 5% unless noted.

Value in ( ) used in some versions.


2 11.6V
1B
Q2
3A
Q3
C B E
Q1
4B
1 11.6V(B)
3 5.0V
4D
4 -11.3V
ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED.

A Howard W. Sams CIRCUITRACE® Photo

DISK DRIVE ANALOG BOARD


J1 VIDEO INPUT
R101 82
VR101 SUB CONTRAST 500
C101 22pF
C102 47µF
2SC829B Q16 VIDEO PREAMP
R102 5600
R103 820
R104 82
R105 180
R106 82
R119 150
D10 3.9B2
C106 .01 10%
C105 47µF
R109 1200
2SC829B Q15 VIDEO AMP
L102
R107 1000
R108 820
C104 10µF
R111 56K
R110 100K
2SC829B Q13 VIDEO AMP
R112 270
C107 47µF
R113 47
P/J5
VR1 CONTRAST 500
R123 47
C108 10µF
R124 68K
2SC829B Q11 VIDEO DRIVER
R114 390
R152 47
2SC1360A Q19 VIDEO OUTPUT
C152 330pF
R153 47
C151 10µF 63V
R151 820 2W
L151
R157 470
SG1
M1 SPARK GAP
R154 10K
C518 1µF 350V
R518 470K
VR503 SUB BRIGHTNESS 200K
R517 47K
VR BR 20
C402 .01 100V 10%
R402 4700
R401 15K
C403 .022 100V 10%
C401 .022 100V 10%
2SC828R Q14 HORIZ BLANKING
R116 1800
C109 .0015 100V
R115 3300
L103
D11
2SC828R Q12 HORIZ BLANKING
R117 3900
R118 560
C110 10µF
R411 500
R412 220
D13
C411 220µF
D12 G1B410
AN5763 IC11 VERTICAL PROCESSOR
C408 33µF
C404 .33µF
R403 47K
VR401 VERT HOLD 100K
C405 10µF
R407 8200
C407 4.7µF
C406 4.7µF
VR403 VERT HEIGHT (SIZE) 50K
VR402 VERT LIN 10K
R406 47K
R404 6.8 2%
R408 1.1 2%
C413 10µF
R410 150
C409 470µF
C410 .033 100V 10%
R409 4.7
R413 330
DY1 DEFL YOKE
P/J7
P/J6
D22 G1B410
R512 680
R510 1200
L503 HORIZ LINEARITY
C515 4µF
R511 1200
L505 WIDTH
120VAC @ 240mAAC P1
POLARIZED
F771 .75A
SW1 POWER
L771
C773 .0047 500V
C774 .0047 500V
C771 .47 400V
R771 2.2M 10%
C772 .1 400V 10%
T1
T2
1AAC
16.3VAC
T2A
D701 G2D61
D703 G2D61
D702 G2D61
D704 G2D61
18.8V @ 900mA
C701 3300µF
R705 27 10W
BD534L Q701 VOLTAGE REG
P/J2
P/J3
C702 4.7µF
R704 1000
L123CB IC701 ERROR AMP
R702 3900
C703 .0068 100V 10%
R703 5100
VR701 VOLTAGE REG 1000
R701 8200
F701 1.5A
R405 6.8 2%
L101 6.5
L501
R01 390
P/J4
D01 POWER GRN
C704 2200µF
C412 470µF
C103 100µF
C510 1000µF
12.0V SOURCE
11.1V SOURCE
11.6V SOURCE
11.8V SOURCE
2SC828R Q17 SYNC AMP
R120 2200
C111 4.7µF
R121 180
AN5753 IC12 HORIZ PROCESSOR
C508 33µF
R505 68
R504 2700 2%
VR501 HORIZ HOLD 500
R503 27K
C505 4.7µF
R502 3300
C504 .01 100V 10%
C507 .001 100V 10%
C506 .0039 500V
C501 .018 100V 10%
C509 .015 100V 10%
T501
R506 10 2W
R501 33K
C502 33pF
C503 .015 100V 10%
L502
BU406 Q18 HORIZONTAL OUTPUT
C511 .047 400V
D14 G1B415
D15 G1B415

A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE

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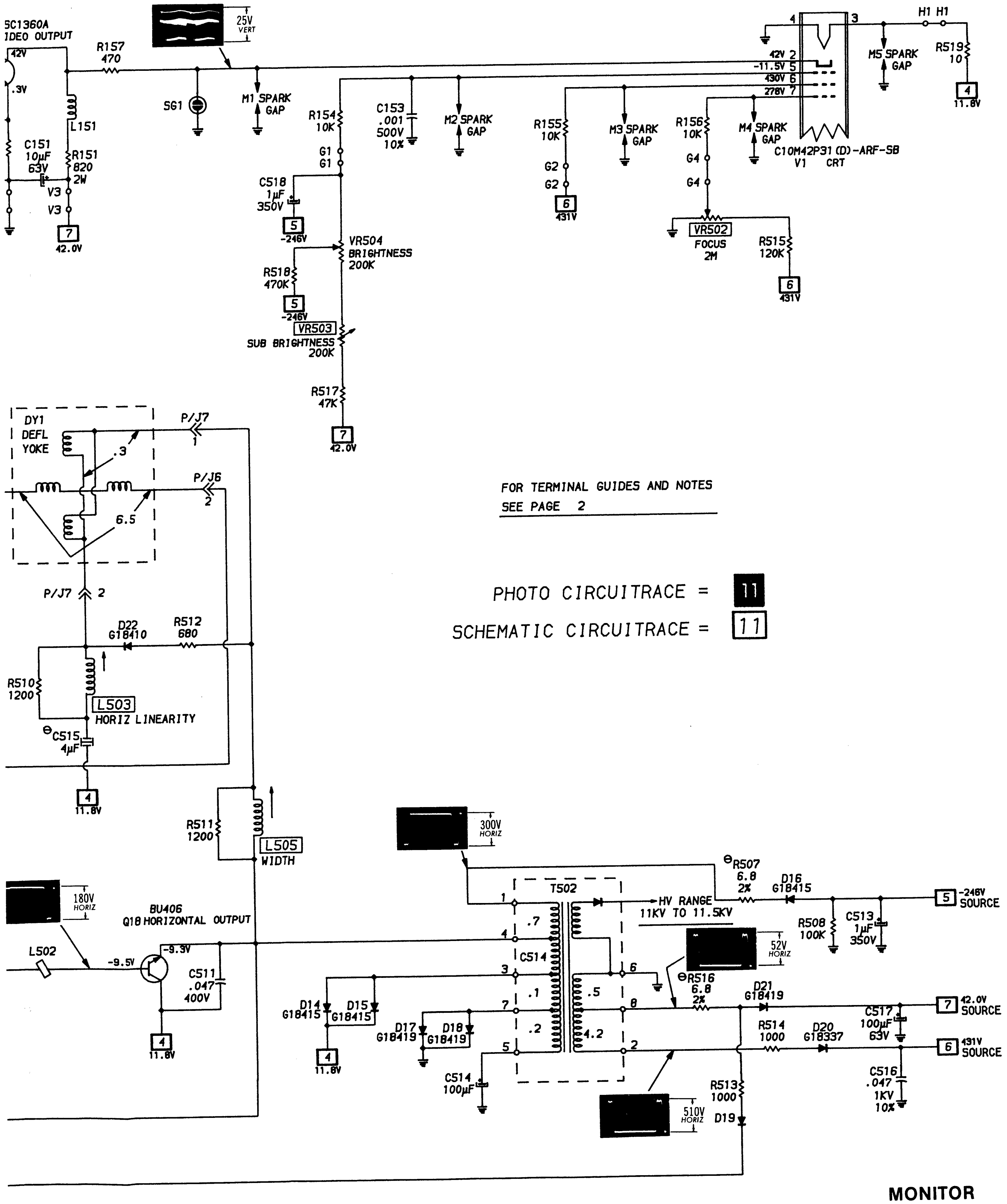

5C1360A
VIDEO OUTPUT
42V
.3V
R157
470
25V VERT
SG1
M1 SPARK GAP
R154 10K
C153 .001 500V 10%
M2 SPARK GAP
R155 10K
M3 SPARK GAP
R156 10K
M4 SPARK GAP
42V 2
-11.5V 5
430V 6
278V 7
4
3
H1 H1
M5 SPARK GAP
R519 10
11.8V
C10M42P31 (D)-ARF-SB
V1 CRT
L151
C151 10μF 63V
R151 820 2W
V3
V3
42.0V
G1
G1
G2
G2
431V
G4
G4
C518 1μF 350V
-246V
VR504 BRIGHTNESS 200K
R518 470K
-246V
VR503
SUB BRIGHTNESS 200K
R517 47K
42.0V
VR502
FOCUS 2M
R515 120K
431V
DY1 DEFL YOKE
.3
6.5
P/J7 1
P/J6 2
P/J7 2
D22 G18410
R512 680
R510 1200
L503
HORIZ LINEARITY
C515 4μF
11.8V
R511 1200
L505
WIDTH
300V HORIZ
180V HORIZ
BU406
Q18 HORIZONTAL OUTPUT
L502
-9.5V
-9.3V
C511 .047 400V
11.8V
R507 6.8 2%
D16 G18415
T502
HV RANGE 11KV TO 11.5KV
-246V SOURCE
R508 100K
C513 1μF 350V
52V HORIZ
R516 6.8 2%
D21 G18419
42.0V SOURCE
D14 G18415
D15 G18415
D17 G18419
D18 G18419
C514
.7
.1
.2
.5
4.2
R514 1000
D20 G18337
C517 100μF 63V
431V SOURCE
C514 100μF
R513 1000
510V HORIZ
D19
C516 .047 1KV 10%
11.8V

FOR TERMINAL GUIDES AND NOTES SEE PAGE 2

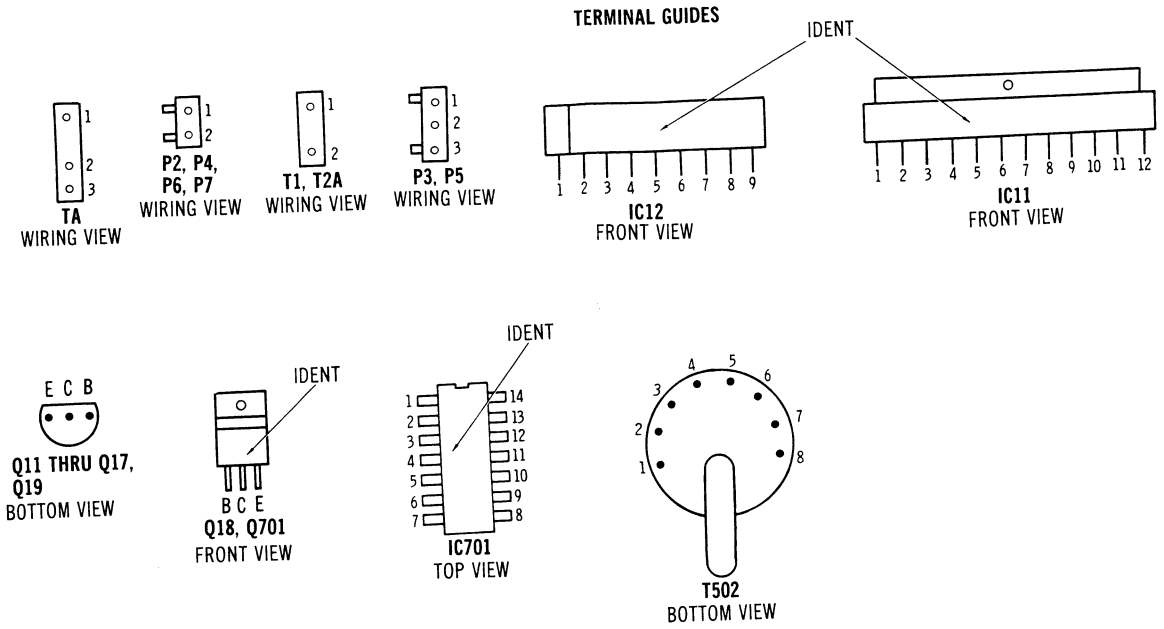
PHOTO CIRCUITRACE = **11**

SCHEMATIC CIRCUITRACE = 11

MONITOR

APPLE MODEL IIc

TERMINAL GUIDES


IDENT
TA
WIRING VIEW
P2, P4, P6, P7
WIRING VIEW
T1, T2A
WIRING VIEW
P3, P5
WIRING VIEW
IC12
FRONT VIEW
IC11
FRONT VIEW
E C B
Q11 THRU Q17, Q19
BOTTOM VIEW
IDENT
B C E
Q18, Q701
FRONT VIEW
IDENT
IC701
TOP VIEW
T502
BOTTOM VIEW

RESISTANCE MEASUREMENTS

MEASUREMENTS TAKEN WITH LOW POWER OHMS METER

ITEM	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PIN 10	PIN 11	PIN 12	PIN 13	PIN 14
IC11	26K	82K	8	7400	10.3K	552	0	10.3K(1)	18K(1)	10.1K	715	45		
IC12	20.8K	INF	18.7K	30.5K	0	105	50	INF	2960					
IC701	INF	INF	INF	3350	INF	INF	0	INF	0	INF	1061	65	INF	INF
V1	470K	450K	28	0	2.2M	2M	1.4M							

ITEM	E	B	C		ITEM	E	B	C		ITEM	E	B	C	
Q11	387	68K	44		Q16	260	6760	858						
Q12	485	15	68K		Q17	2190	1008	44						
Q13	266	36K	44		Q18	INF	INF	38						
Q14	3300	INF	44		Q19	47	434	INF						
Q15	259	1233	861		Q701	65	1061	38						

(1) Reading may vary according to the condition of the electrolytic in the circuit.

SCHEMATIC NOTES

—✱— Circuitry not used in some versions

- - - Circuitry used in some versions

⊖ See parts list

⏚ Ground

⫽ Chassis

Waveforms and voltages taken from ground, unless noted otherwise

Voltages, logic readings and waveforms taken in Power Up mode, Caps Lock and 80/40 Column keys down, Keyboard Switch up, no diskette in the Disk Drive "Apple IIc" and "Check Disk Drive" displayed on the Monitor screen.

Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on 0 reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7 cm. width with DC reference voltage given at the bottom line of each waveform.

Time in μsec. per cm, given with p-p reading at the end of each waveform.

Item numbers in rectangles appear in the alignment/adjustment instructions.

Supply voltages maintained as shown at input.

Controls adjusted for normal operation.

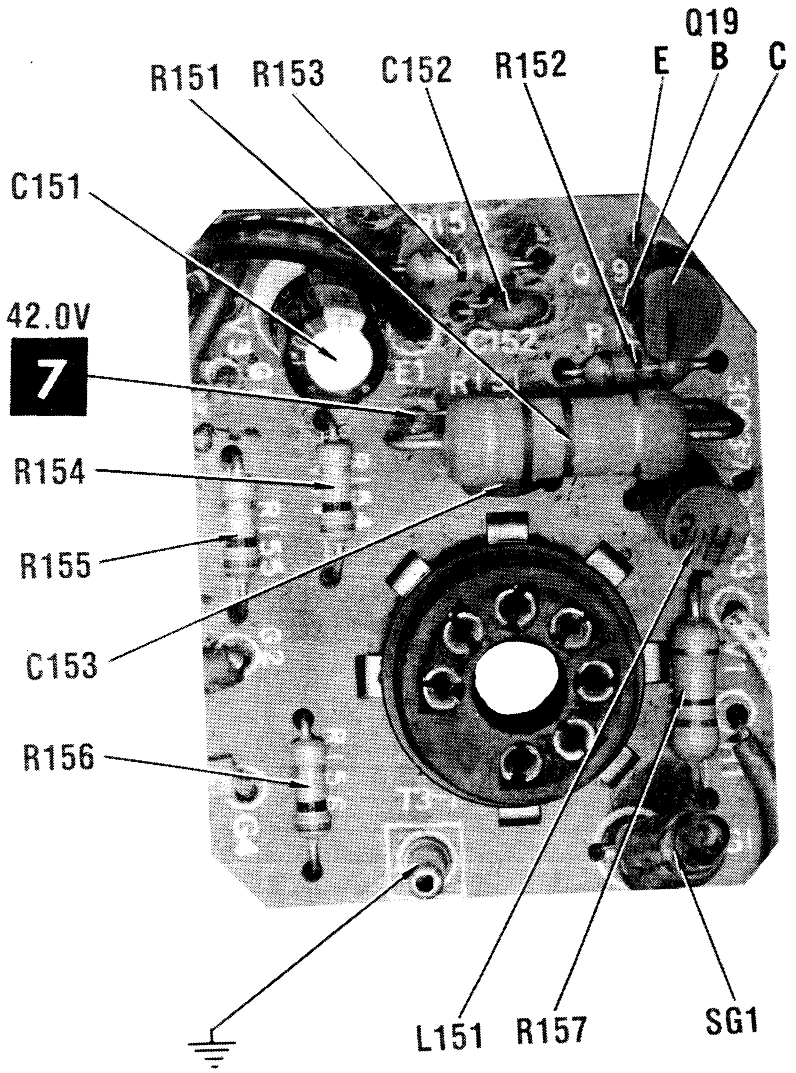
Terminal identification may not be found on unit.

Capacitors are 50 volts or less, 5% unless noted.

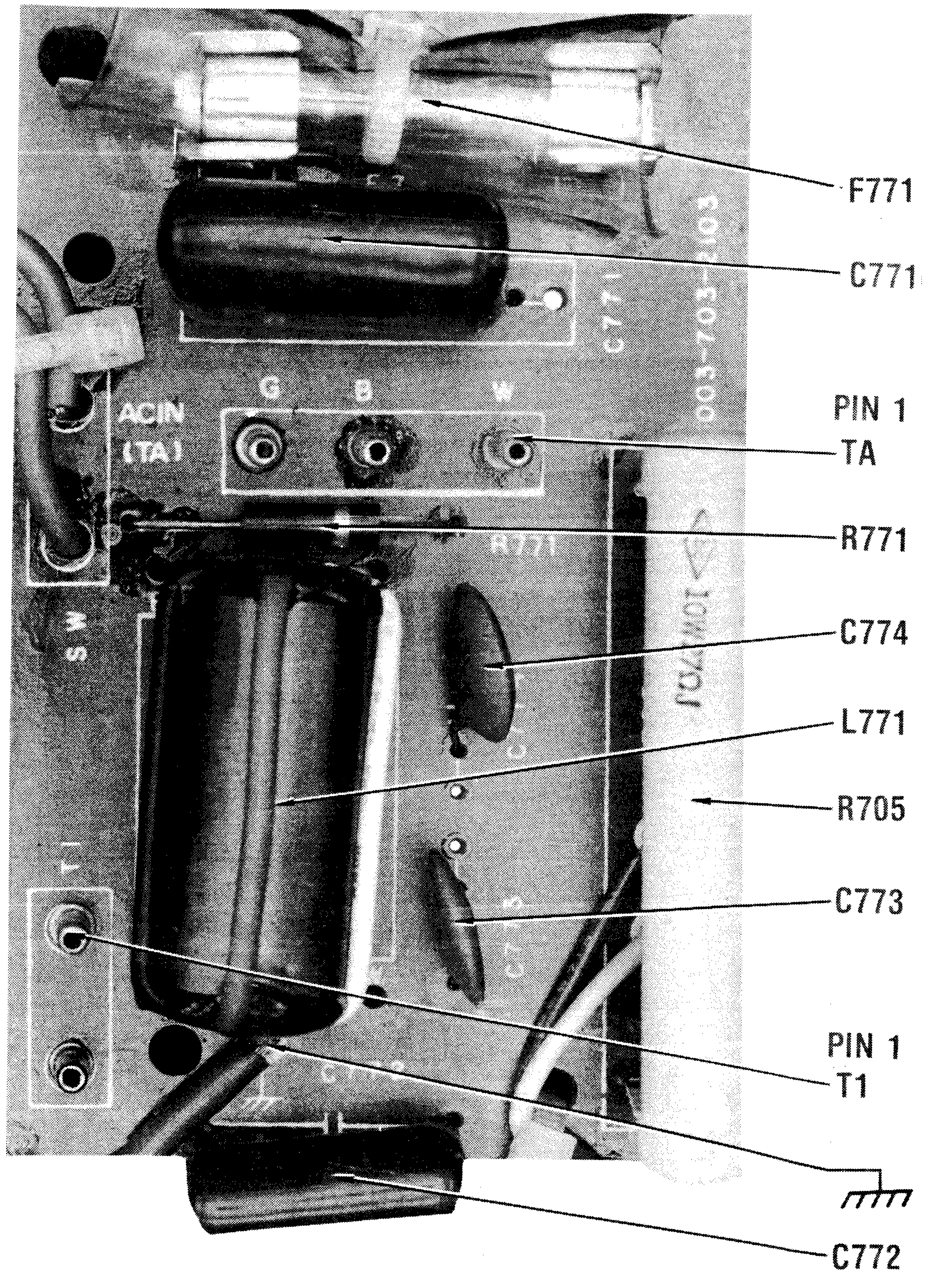
Electrolytic capacitors are 50 volts or less, 20% unless noted.

Resistors are ½W or less, 5% unless noted.

Value in ( ) used in some versions.


R151
R153
C152
R152
Q19
E
B
C
C151
42.0V
7
R154
R155
C153
R156
L151
R157
SG1

CRT SOCKET BOARD A Howard W. Sams CIRCUITRACE® Photo


F771
C771
PIN 1
TA
R771
C774
L771
R705
C773
PIN 1
T1
C772

MONITOR POWER SUPPLY BOARD

P
S

CABINET REMOVAL

Remove two screws holding r
of the rear panel out and lift u
two screws holding top vent p
move two screws holding rec
move handle. Remove two scr
and two screws holding cabine
bottom. Remove four screws
remove front cabinet from CR

MAIN BOARD REMOVAL

Remove ten screws holding
shield. Remove two screws fr

CRT IMPLOSION PROTECTIC

Implosion protection is an int
cleaning accomplished withou

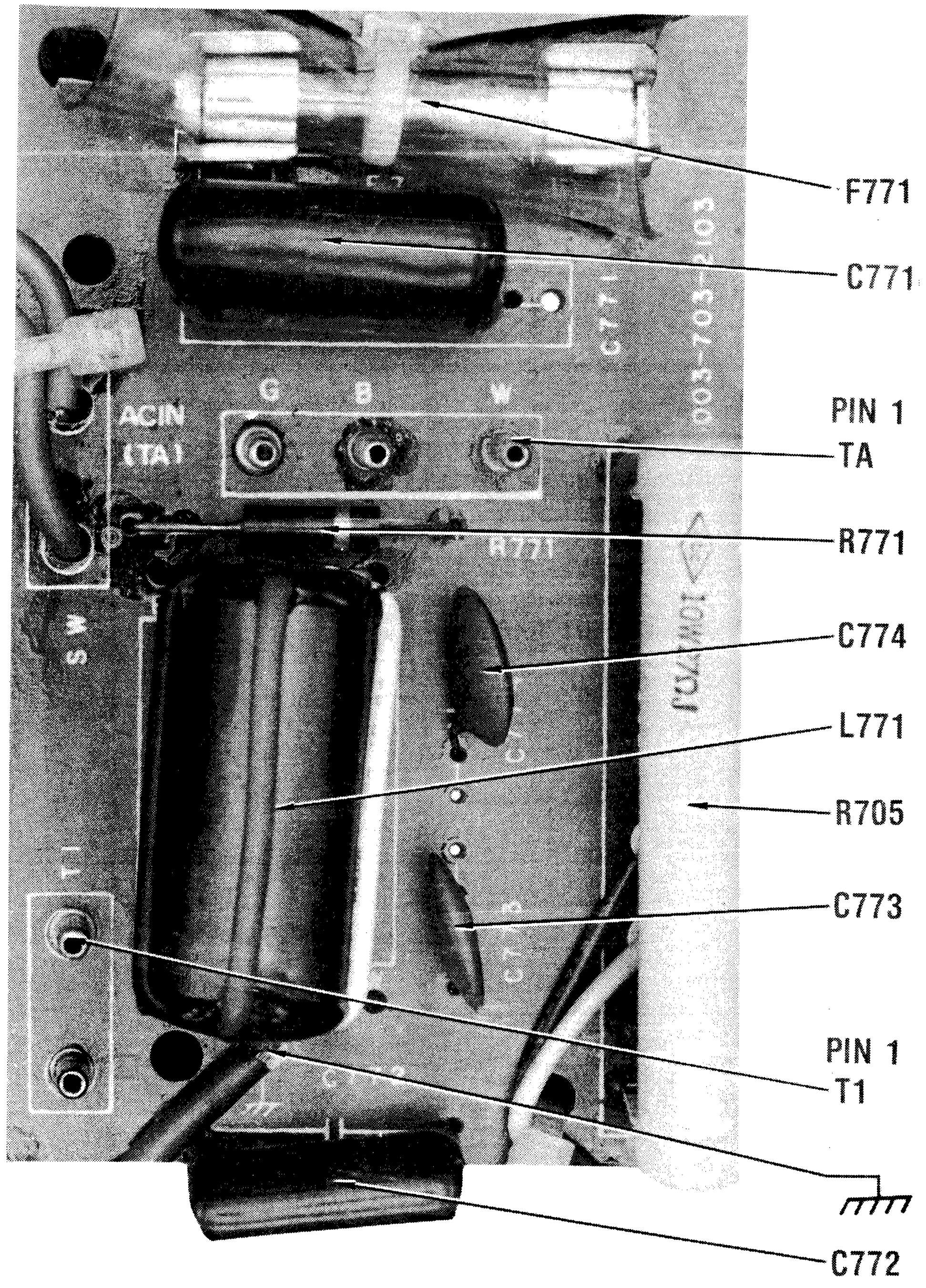
FUSE DEVICES

A 1.5-amp fuse is used for low
tion.

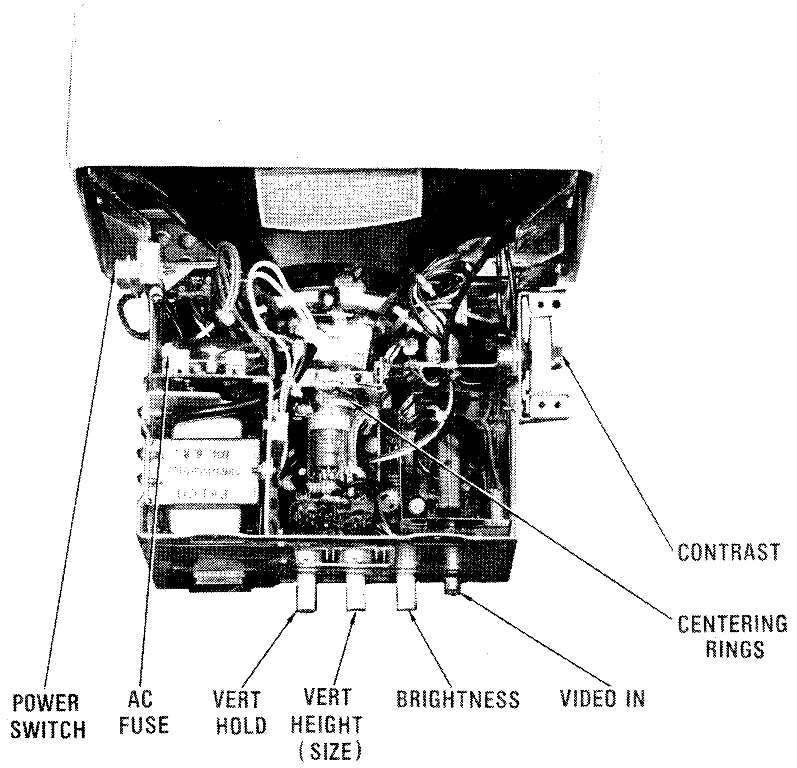
A .75-amp fuse is used for AC

HORIZONTAL OSCILLATOR

Adjustment of the horizontal
proper setting of the Horizont



MONITOR POWER SUPPLY BOARD



CABINET VIEW

DISASSEMBLY INSTRUCTIONS

CABINET REMOVAL

Remove two screws holding rear panel. Pull the lower part of the rear panel out and lift up to remove panel. Remove two screws holding top vent panel and slide panel out. Remove two screws holding recessed handle section and remove handle. Remove two screws holding contrast control and two screws holding cabinet bottom and remove cabinet bottom. Remove four screws holding the front cabinet and remove front cabinet from CRT.

MAIN BOARD REMOVAL

Remove ten screws holding bottom shield and remove shield. Remove two screws from bottom of Main board and two screws from sides of chassis holding front brackets to Main board. Pull the Main board down. Disconnect CRT socket and HV anode lead. Disconnect eight connectors from Main board and one connector from AC input board. Remove Main board.

CRT REMOVAL

Follow the "Cabinet Removal" procedure. Disconnect CRT socket, HV anode lead and the deflection yoke. Remove four screws holding CRT to cabinet front. Remove the CRT. Loosen and remove the deflection yoke from neck of CRT.

SERVICING IN THE FIELD

CRT IMPLOSION PROTECTION AND CLEANING

Implosion protection is an integral part of the picture tube, cleaning accomplished without CRT removal.

FUSE DEVICES

A 1.5-amp fuse is used for low-voltage power-supply protection.

A .75-amp fuse is used for AC line protection.

HORIZONTAL OSCILLATOR

Adjustment of the horizontal hold is accomplished by the proper setting of the Horizontal Hold Control.

WIDTH

The width may be varied by adjusting the width coil.

FOCUS

The focus may be varied by a focus control.

CENTERING

Centering is accomplished by proper adjustment of two magnetic rings located on the yoke rear cover.